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ANNUAL REPORT

OF THE

SECRETARY OF WAR

FOR

THE YEAR 1893.

IN FOUR VOLUMES.

VOLUME II—IN SIX PARTS.

PART 1.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

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ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1893.

REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., September 19, 1893.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1893:

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, U. S. Army, at the end of the fiscal year was 121.

Since the last annual report the corps has lost three of its officers—Col. David C. Houston, who died at New York City, May 18, 1893; Maj. L. Cooper Overman, who resigned September 20, and Capt. Edward Maguire, who died at Philadelphia, Pa., October 11, 1892.

There were added to the corps, by promotion of graduates of the Military Academy, two additional second lieutenants, July 28, 1892, and five, June 28, 1893.

On the 30th of June, 1893, the officers were distributed as follows:

Commanding the Corps of Engineers and the Engineer Department	1
Office of the Chief of Engineers and Light-House Board	1
Office of the Chief of Engineers	2
Board of Engineers, fortifications, river and harbor works, California Débris Commission, and Division Engineer	1
Board of Engineers, Board of Ordnance and Fortification, and Division Engineer	1
Fortifications, river and harbor works, and Division Engineer	1
Board of Engineers, Mississippi River Commission, Division Engineer, and Board of Visitors	1
River and harbor works and Division Engineer	1
Washington Aqueduct	1
Board of Engineers, fortifications, river and harbor works, and Board of Visitors	2
Public buildings and grounds and Light-House Board	1
Fortifications and river and harbor works	24
Mississippi River Commission, Missouri River Commission, and light-house districts	1
River and harbor works and light-house districts	2
Fortifications, post of Willets Point, U. S. Engineer School, and Battalion of Engineers	1

Fortifications, river and harbor works, and California Débris Commission	1
River and harbor works	30
River and harbor works and Missouri River Commission	1
River and harbor works, California Débris Commission, and light-house district.	1
Fortifications, river and harbor works, and light-house districts	2
Battalion of Engineers and U. S. Engineer School	14
River and harbor works and Columbian Exposition	2
Mississippi River Commission	1
Missouri River Commission	1
Leave of absence, including five graduates of the Military Academy	7
Detached, on International Boundary Commission, at Military Academy, with Light-House Establishment, as military attachés, with Board of Commissioners of the District of Columbia, and at headquarters military department	20
	121

The officers detached were on duty as follows:

Lieut. Col. John W. Barlow and Lieut. David DuB. Gaillard, members of International Boundary Commission	2
Maj. Oswald H. Ernst, Superintendent Military Academy	1
Maj. David P. Heap, engineer third light-house district	1
Maj. Milton B. Adams, engineer ninth and eleventh light-house districts	1
Maj. William R. Livermore, engineer first and second light-house districts	1
Maj. James C. Post, military attaché to the United States legation at London	1
Capt. Frederick A. Mahan, engineer secretary of the Light-House Board	1
Capt. Charles F. Powell, Engineer Commissioner of the District of Columbia	1
Capt. Eric Bergland, engineer fifth and sixth light-house districts	1
Capts. George McC. Derby and Gustav J. Fiebeger, assistants to the Engineer Commissioner of the District of Columbia	2
Capt. James L. Lusk and Lieuts. Mason M. Patrick and Charles S. Bromwell, on duty with Company E, Battalion of Engineers, and at Military Academy	3
Capt. Theodore A. Bingham, military attaché to the United States legation at Rome	1
Lieuts. Lansing H. Beach, Joseph E. Kuhn, and Henry C. Newcomer, on duty at Military Academy	3
Lieut. Cassius E. Gillette, engineer officer, department of the Missouri	1
	20

FORTIFICATIONS.

During the past fiscal year projects have been prepared for the defense of Tybee Roads and the entrance of Savannah River, Georgia; of Narragansett Bay, Rhode Island; of Charleston, S. C., and Pensacola, Fla., and a partial project for the defense of New Orleans, La.

The complete projects have received the approval of the Secretary of War; and in submitting an estimate for gun and mortar emplacements, the commencement of work on each of these new projects has been contemplated, as well as the continuation of work on projects hitherto prepared. The amount of this estimate is $1,629,126; and this it is proposed to apply almost wholly to new works. While there are balances on hand from previous appropriations, they justify no reduction of this estimate, as they pertain to the construction of emplacements now progressing. The proposed new works are emplacements for three 12-inch, seven 10-inch, and three 8-inch guns, and four mortar batteries. Should these works be authorized, provision will still not have been made for mounting all the guns which the Ordnance Department expects to be completed by the end of the present fiscal year. Such provision will be lacking for five 12-inch and thirty-one 8-inch guns. Nor can it be hastily provided. The estimate for one disappearing battery for five guns contains such amounts as these: 25,210 cubic yards of concrete; 26,000 cubic yards of excavation, and 12,000 of embankment. Evidently the element of time can not be disregarded in the construction of fortifications.

Funds hitherto appropriated have been allotted to the construction of emplacements for modern rifled guns and mortars as follows:

Locality.	Guns.				Mortars.
	12-inch.	10-inch.	8-inch.	Rapid fire.	12-inch.
Portland, Me		2			
Boston, Mass		4			16
New York, N. Y	2	3	5	2	32
Washington, D. C		2			
Hampton Roads, Va		3			
San Francisco, Cal	2	6			16
Total	4	20	5	2	64

The projected fortifications at the above localities and the progress made in their construction are as follows:

Portland Harbor, Maine.—Officer in charge, Lieut. Col. P. C. Hains, Corps of Engineers.

The approved project for the defense of this harbor contemplates, for the present, an armament of eighteen 12-inch guns on lifts, ten 10-inch and ten 8-inch guns on disappearing carriages, forty-eight 12-inch mortars, and submarine mines to be operated from four mining casemates.

Under an allotment of $110,000, from the appropriation of July 23, 1892, the construction of emplacements for two 10-inch guns was commenced early in April, 1893, and has been in progress since.

A cement storehouse of about 2,000 barrels capacity, a sand bin, and one for broken stone have been built; also a tramway from the latter to the site of the battery. Needed repairs to the old buildings have been made. A stone-crushing plant is being established. Sites for both gun platforms and for one magazine have been cleared; the site for the second magazine is partly cleared and the rock excavation for the road back of the emplacements is in progress. Earth obtained in clearing the site has been placed for use as cover. Much rock excavation of a difficult character has been necessary.

One mining casemate was completed during the year at a cost of $8,979.75, and the construction of two more was commenced June 1, 1893. Both sites have been cleared and the excavation, which is almost entirely in rock, is progressing.

Boston Harbor, Massachusetts.—Officer in charge, Lieut. Col. S. M. Mansfield, Corps of Engineers, with Capt. S. S. Leach, Corps of Engineers, under his immediate orders until December 7, 1892.

The approved project for the defense of this harbor contemplates, for the present, an armament of twelve 12-inch guns on lifts, fifteen 10-inch and five 8-inch guns on disappearing carriages, one hundred and twenty-eight 12-inch mortars, and submarine mines to be operated from four mining casemates.

At the beginning of the year three emplacements for 10-inch guns were under construction. At one of these the work has been carried nearly as far as is practicable until the placing of the platform is begun. At the two other emplacements about half of the old masonry and earth slopes, which must be displaced by the new work, had been removed, and about 4,000 cubic yards of concrete had been put in place, or sufficient to construct the masonry of about one-half of one

of the emplacements. More than half of the sand and concrete stone needed for the new work had been collected and stored.

Under an allotment of $58,000, from the appropriation of July 23, 1892, the construction of a fourth emplacement for a 10-inch gun was commenced in December, 1892. The necessary working plant has been collected and arranged; about 2,500 cubic yards of earth has been excavated and placed in new embankment. Contracts are in force for the delivery of the necessary concrete materials, and the receipt and storage of sand, cement, and stone has begun.

At the beginning of the year the construction of a battery for sixteen 12-inch mortars was in progress.

During the year the masonry of this battery was completed with the exception of the platforms; and the earth embankment essentially completed with the exception of the final regulation and sodding of the slopes. March 14, 1893, $10,000 was allotted from the appropriation of February 18, 1893, for the construction of platforms for four of the mortars, which will be shortly undertaken.

Two mining casemates have been completed, and on May 29, 1893, an allotment was made for the construction of a third. The necessary repairs of buildings for laborers and materials have been commenced.

Narragansett Bay, Rhode Island.—Officer in charge, Capt. W. H. Bixby, Corps of Engineers, with Second Lieut. W. W. Harts, Corps of Engineers, under his immediate orders; Division Engineer, Col. H. L. Abbot, Corps of Engineers.

The approved project for the defense of this bay contemplates an armament of ten 12-inch guns on lifts, six 10-inch and four 8-inch guns on disappearing carriages, eighty 12-inch mortars, and submarine mines to be operated from two mining casemates.

Funds were allotted September 21 and October 26, 1892, for the construction of the two mining casemates. Since those dates, arrangements have been completed for housing and subsisting the working force for one of these casemates and a large proportion of the necessary excavation has been done. All the cement, about one-quarter of the sand, and some of the lumber required for these works, have been received.

New York Harbor, New York.—Officers of the Corps of Engineers in charge: Col. D. C. Houston, until May 18, 1893; Lieut. Col. H. M. Robert, since June 12, 1893; Lieut. Col. G. L. Gillespie, with First Lieut. J. G. Warren under his immediate orders, and Lieut. Col. W. R. King. First Lieut. T. H. Rees has been under the immediate orders of Col. Houston and Lieut. Col. Robert since April 5, 1893, except from May 18 to June 12, during which period he was temporarily in charge of works.

The projects for the defense of both the southern and eastern entrances to this harbor contemplate, for the present, an armament of twenty-one 12-inch guns on lifts, fifteen 10-inch and nine 8-inch guns on disappearing carriages, one hundred and seventy-six 12-inch mortars, and submarine mines operated from five mining casemates.

At the beginning of the fiscal year there were under construction emplacements for two 12-inch, two 10-inch, and four 8-inch guns and thirty-two mortars. August 2, 1892, the construction of an additional emplacement for an 8-inch gun was authorized; and November 8, 1892, that of an emplacement for a 10-inch gun, together with two magazines and two casemates for rapid-fire guns.

The five mining casemates and one building for the storage of submarine mining materials are completed and a second storage building under construction.

Lieut. Col. Robert reports as to four emplacements for 8-inch guns: The concrete work is completed except the platforms and the vacant space left in front of each emplacement, to be filled after the platforms are built; the earth parapet of these positions is completed except a small amount of grading and sodding; the terreplein is roughly graded; the ditch in the rear of the battery is excavated and paved, and the rear earth slope is graded.

This officer also reports as to the storage building that the concrete foundation and about half of the lower of the two stories are built.

Relative to the construction of the gun battery for two 12-inch guns, of one emplacement for a 10-inch gun, one mortar battery, and one storage building, Lieut. Col. Gillespie reports: The construction of the masonry of the battery was practically completed at the close of the fiscal year. The completed battery contains 42,410 cubic yards of masonry as follows: 39,013 of concrete, 1,525 of large stone bedded in concrete, 538 of cut granite, 308 of flagging, and 1,027 of finished pavement of superior and exterior slopes and of the floors of the magazines and galleries. The average cost per cubic yard was not quite $4.71, all contingencies included.

The embankment of sand, which, resting against the exterior wall, surrounds the battery excepting at the defensible entrance, was also completed during the year, 5,185 cubic yards of sand having been deposited therein, at a cost of not quite 22¼ cents per yard.

One 12-inch gun is now mounted in this battery and the manufacture and erection of the mechanism of the second lift is in progress.

Toward the emplacement for one 10-inch gun and adjacent magazines and casemates for rapid-fire guns about 2,700 cubic yards of material has been excavated for the foundations and deposited in the exterior slope, a suitable wharf and concrete plant nearly completed, and all preparations made to commence the construction of concrete masonry at an early date. The allotment of $82,000 for this work was made November 8, 1892, from the appropriation of July 23, 1892.

At the close of the fiscal year the concrete masonry of the mortar battery was completed, excepting about 160 feet of the counter-scarp wall, the sloping concrete surface (for protecting the slopes from damage by blast) in one pit and entrance, and the top finish of the floors in the magazines and passages. In all 26,852 cubic yards of concrete had been put in place at an average cost, including superintendence, purchase and maintenance of plant, and all contingencies, of $5.20 per yard.

During the year 118,478 cubic yards of sand was excavated, hauled, and deposited in the embankments; the total to June 30, 1893, is 127,927 cubic yards, and the filling inside the line of the ditch is completed, excepting about 5,000 yards. The average cost, including all contingencies, was 28 cents per cubic yard.

Proper arrangements have been made for drainage and a bombproof room has been provided for the engine and dynamo of an electric-light plant for the illumination of the interior of the work.

During the year an allotment of $20,000 was made for the construction of eight of the sixteen mortar platforms required for the completion of the work. Four spring-return mortar carriages are now in readiness for mounting as soon as the platforms are completed.

The storage building is completed, excepting the erection of an overhead trolley for handling the heavier parts of the system, and will furnish adequate storage for all mining material required for the submarine defenses to be operated from its vicinity.

Additional details of the works of which Lieut. Col. Gillespie is in charge will be found in Appendix No. 1.

Concerning the construction of emplacements for two 10-inch and one 8-inch guns and of one mortar battery, Lieut. Col. King reports: Two emplacements are completed as far as the work can be carried until the plans for platforms and interior walls are decided upon. The third emplacement will reach a like stage of completion during the present working season. During the fiscal year 10,093 cubic yards of concrete was laid, 10,628 cubic yards of earth excavated, and 4,384 yards replaced in embankment.

The nature of the site of the mortar battery has necessitated blasting the magazines and mortar pits from the solid rock. Excavated material will all be used in the masonry and earthwork of the battery. The excavation of rock is nearly completed. During the year 1,939 cubic yards of rock has been excavated and 2,166 yards of earth excavated and placed in embankment. One thousand eight hundred and sixty yards of stone has been crushed for concrete and 1,952 yards of concrete laid. In case of emergencies platforms could be laid and mortars then mounted in the pits in their present condition. But even this would be the work of many weeks.

Philadelphia, Pa.—In charge of Maj. C. W. Raymond, Corps of Engineers, with Second Lieut. A. M. D'Armit, Corps of Engineers, under his immediate orders; Division Engineer, Col. H. L. Abbot, Corps of Engineers.

The project for the defense of Philadelphia by high power-guns is as yet unprepared; but its submarine defense will be by mines operated from three mining casemates.

During the past fiscal year the construction of one casemate was completed and a second casemate, constructed in 1876, was modified with a view of providing the additional cover rendered necessary by the increased power of modern ordnance. The cost of constructing one casemate was $37,760.13; of modifying the second casemate, $27,765.56.

Baltimore, Md.—In charge of Col. W. P. Craighill, Corps of Engineers.

The project for the defense of this harbor by batteries is under consideration. Its submarine defense will be by mines operated from one mining casemate. An allotment for this casemate was made January 6, 1893, and the work was essentially completed at the close of the fiscal year.

Washington, D. C.—Officer in charge, Maj. C. E. L. B. Davis, Corps of Engineers, with First Lieut. G. A. Zinn, Corps of Engineers, under his immediate orders; Division Engineer, Col. W. P. Craighill, Corps of Engineers.

The approved project of defense contemplates emplacements for four 12-inch guns on lifts, six 10-inch and three 8-inch guns on disappearing carriages, eight 12-inch mortars, and submarine mines operated from two mining casemates.

The construction of emplacements for two 8-inch guns has continued during the fiscal year. The necessary excavation has been completed and the mixing and laying of concrete for the parapet has been in progress. The concrete is mixed by machinery, and both the concrete material and the mixed concrete are transferred in cars. The work was suspended during the past winter, which was unusually severe.

One mining casemate, costing $15,784.95, is now complete, the slopes of the excavation made for cover having been shaped, soiled, and seeded.

Hampton Roads, Virginia.—Officer in charge, Maj. C. E. L. B. Davis, Corps of Engineers; with First Lieut. G. A. Zinn, Corps of Engineers, under his immediate orders; Division Engineer, Col. W. P. Craighill, Corps of Engineers.

The approved project of defense contemplates, for the present, five 12-inch guns on lifts, ten 10-inch guns on disappearing carriages, thirty-two 12-inch mortars, and submarine mines operated from two mining casemates.

At the beginning of the fiscal year, the construction of emplacements for two 10-inch guns was progressing and is now well advanced. The concrete for the parapet is all in place and about half of the earthwork on the front is completed. Under an allotment of $64,000, from the appropriation of July 23, 1892, the construction of an emplacement for a third 10-inch gun was authorized December 13, 1892.

A track has been built for operating a steam railway, the necessary plant for hauling concrete has been installed, and the mixing and laying of concrete has been commenced.

One mining casemate is completed, its cost having been $29,452. A storehouse for mining material is also provided.

Charleston Harbor, South Carolina.—Officer in charge, Capt. F. V. Abbot, Corps of Engineers; Division Engineer, Col. W. P. Craighill, Corps of Engineers.

The approved project for the defense of this harbor contemplates an armament of six 12-inch guns on lifts, four 10-inch guns on disappearing carriages, sixteen 12-inch mortars, and submarine mines to be operated from one mining casemate.

During the last fiscal year the mining casemate has been completed at a cost of $13,100.

San Francisco Harbor, California.—Officers in charge, Col. G. H. Mendell, with Second Lieut. C. A. F. Flagler under his immediate orders, and Lieut. Col. W. H. H. Benyaurd, with First Lieut. C. L. Potter under his immediate orders, all officers of the Corps of Engineers.

The approved project of defense contemplates, for the present, eighteen 12-inch guns on lifts, twenty-three 10-inch, and thirteen 8-inch guns on disappearing carriages, fifteen 12-inch, five 10-inch, and six 8-inch guns on nondisappearing carriages, one hundred and forty-four 12-inch mortars, and submarine mines operated from seven mining casemates.

One mining casemate is completed, and two, while incomplete, can readily be completed while in use.

Col. Mendell has charge of the construction of emplacements for three 10-inch guns on disappearing carriages and for three 10-inch guns on nondisappearing carriages, and of a battery for sixteen 12-inch mortars. Three of the gun emplacements are completed as far as can be pending the adoption of service-depressing carriages; the remaining three are practically ready for their platforms.

Ground was broken for the mortar battery on April 5, 1893. The excavation for the rooms and passages and the drainage over the excavated portion are completed. Concrete work is well underway. Rooms, passages, and one pit will be completed, including platforms in the latter, during the present year. Further details of the works under the charge of Col. Mendell are given in Appendix No. 2.

Under an allotment of $72,000 made November 9, 1892, from appropriation of July 23, 1892, Lieut. Col. Benyaurd in February, 1893, commenced the construction of emplacements for two 12-inch guns on nondisappearing carriages. An old wharf was repaired and extended;

stables and workshops erected; a concrete plant set up; and contracts were made for materials needed in the construction. The excavation, commenced in February, continued until the end of April, included the removal of old concrete and stone masonry, and amounted to 5,399 cubic yards. The natural site is loose rock, unfit, however, for concrete. So far the excavation has been for magazines and wingwalls, and has not included that for the parapet. One thousand three hundred and eighty-four cubic yards of concrete has been placed in position.

Lieut. Col. Benyaurd commenced the construction of a mining casemate in January. When doors, steps, and a surface drain have been put in the casemate will have been completed. Further details as to this work are given in Appendix No. 3.

Of the emplacements under construction, as above reported, two being provided with lifts need no additional platforms, and those for twenty mortars will be provided with platforms with funds appropriated by act of February 18, 1893. But emplacements for two 12-inch, seventeen 10-inch, and five 8-inch guns, and for forty-four 12-inch mortars are, or during the present working season will be, ready for their platforms. The guns and mortars will be ready for all of these by June 30, 1894, and mounting these should not be delayed. An estimate of $264,000 is therefore submitted for gun and mortar platforms.

An estimate of $51,550 is submitted for the purchase of submarine mines and necessary appliances. As above reported, many casemates have been built, but cable and mines, with storage buildings and tanks, have to be purchased or built, and the amount estimated will enable this preparation to be continued. The estimate of $50,000 for needful casemates and cable galleries, which is submitted, will by no means suffice for the construction of casemates whose construction is projected, but will, with the available balance, enable this work to progress with that of the construction of correllated defenses.

SITES FOR FORTIFICATIONS.

These are acquired by condemnation, purchase, or donation, as authorized by the act approved August 18, 1890.

During the fiscal year payment has been made for five small lots, part of the site for mortar batteries, and for three lots, part of the site for a gun battery, at Grovers Cliff, Mass. About four acres remain to be acquired at these sites. Condemnation proceedings to acquire this remnant were instituted, but suspended on receipt of favorable propositions to sell. The acceptance of these has been authorized, but the purchase is still incomplete.

Near Fort Wadsworth four tracts having an area of 82 acres, with the buildings thereon, have been acquired by condemnation. The value of this property as adjudged by the court of condemnation in November, 1892, was $568,000; and the price paid by the United States January 9, 1893, was $599,497.30. The excess of the price paid over the adjudged value includes costs, extra allowances, interest for one month and fifteen days at 6 per cent, services of district attorney and commissioners, and expenses attending condemnation.

By the act of the legislature of the State of New York, March 27, 1893, jurisdiction was ceded to the United States over the land acquired adjacent to the eastern side of the Fort Hamilton reservation.

By act approved July 23, 1892, an appropriation of $25,000, or so much thereof as might be necessary, was made "to enable the Secretary of

War, in his discretion, to purchase the land adjoining the Government reservation at Sandy Hook, N. J., now belonging to the grantees of the Highland Beach Association of New Jersey, together with the right of way from said land to the main line of the Central Railroad Company of New Jersey, together with the rails, ties, switches, and all the railroad equipment on said lands."

The purchase has been made at a cost of $25,000; the area acquired is represented as being nearly 28 acres.

Proceedings were continued looking to the acquisition of 90.6 acres at Sheridans Point below Washington, D. C., on the Potomac River. The commissioners first appointed to appraise this tract assessed it at $140 per acre. This figure being considered excessive, new proceedings were instituted. The commissioners under the new proceedings appraised the land at about $150 per acre. The United States district attorney was of the opinion that no lower appraisement could be hoped for, and hence the last was accepted and the report of the commissioners was confirmed June 10, 1893. The award of $13,576.87 was paid in July, 1893, in conformity to the orders of the United States circuit court for the eastern district of Virginia.

A tract of 54.05 acres at Point Lobos, Cal., was condemned, and December 29, 1892, the award therefor of $75,000 and incidental expenses so far reported, amounting to $406.10, have been paid This tract is to be used as a site for part of the defenses of San Francisco.

At Cushings Island, Portland Harbor, Me., a detailed survey has been made to determine the minimum area needed on that island as a site for batteries for the defense of the harbor. The Secretary of War has requested the Department of Justice to institute proceedings for the condemnation of about 33.4 acres.

After payment is made for the tracts at Sheridans Point, Va., and Cushings Island, Me., the balance of available funds will probably not exceed $75,000. It is estimated that nearly 1,700 acres should be acquired at different localities on the coast; much of this land continues to increase in value from year to year, and it is to the interest of the Government that it should be acquired at an early date. Therefore, an estimate of $500,000 is submitted for the purchase of sites for seacoast defenses.

PROTECTION OF THE SITE OF FORT NIAGARA, NEW YORK.

Officer in charge, Capt. Dan C. Kingman, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

Protection of site.—Operations have been in progress for the protection of the site of Fort Niagara under allotments made from the appropriations for "sea walls and embankments" and preservation and repair of fortifications. The project provides for the repair of the sea wall along the lake front, the construction of dikes of fascines, iron pickets, and stone along the river and a portion of the lake front, and the filling in behind these dikes along the river front to a height of 6 feet above low water, leaving a flat slope down to the water. Above this slope is a level place wide enough for a roadway, then a steeper slope up to the general level of the site, the lower slope to be protected by a growth of willows and the upper one by sod.

The total amount expended under this project to June 30, 1893, is $29,717.13, which has resulted in the repair of the sea wall, the construction of 1,711 linear feet of dike work, 941 feet of which is along the river, the construction of a concrete breakwater in front of the north-

west angle to protect the wall, and in grading the bank along the river front according to the project for a distance of 941 feet. The grading was completed late in the season, and, as it was impossible to induce a growth of willows on this slope that would be any protection to it during the winter and spring freshets, it was therefore covered with a rough pavement of stone. This answers the purpose so well that there seems to be no occasion to plant the willow.

July 1, 1892, balance unexpended	$550.62
June 30, 1893, amount expended during fiscal year	267.75
July 1, 1893, balance unexpended	282.87
Amount (estimated) required for completion of existing project	26,105.30
Amount that can be profitably expended in fiscal year ending June 30, 1895.	13,000.00

(See Appendix No. 4.)

SEA WALL AND EMBANKMENT AT DAVIDS ISLAND, NEW YORK HARBOR

Officers of the Corps of Engineers in charge: Col. D. C. Houston, until May 18, 1893; Lieut. Col. H. M. Robert, since June 12, 1893, and First Lieut. T. H. Rees has been under the immediate orders of Col. Houston and Lieut. Col. Robert since April 5, 1893, except from May 18 to June 12, during which period he was temporarily in charge of work.

Davids Island, 21 miles distant by water from the Battery, New York City, is one of the principal recruiting stations of the Army. On the east side of the island was a bay into which garbage and refuse matter frequently drifted, becoming a source of annoyance and possible disease to the troops stationed there. Separated from the bay by a low sand beach was a fresh water pond, formerly used as a water supply during drought, and still used as an ice pond.

To protect the pond from salt water, as well as for sanitary reasons, the construction of a sea wall in front of this beach was recommended in 1883 and 1884. In 1886 $47,000 was estimated as the cost of a masonry wall about 980 feet long, with embankment behind, the wall to be placed near low-water line and to rise to 12 feet above mean low-water level.

Under the appropriation of September 22, 1888, $47,000 was allotted for this sea wall and embankment. Recent stringent regulations prevent the deposit of garbage in this vicinity; therefore a riprap wall with dimension stone capping was substituted for the masonry wall originally designed, the cost being less and the wall equally effective.

The sea wall was completed in April, 1890.

The wall and embankment are in good condition. Slight repair to the embankment is needed where heavy storms have washed away part of the earth.

A survey of the shores of the island made in June, 1891, to prepare estimates of cost of other needed sea walls upon this island showed that protection is needed at the west shore, north of the coal dock. A suitable sea wall with embankment at this place is estimated to cost $30,000.

Estimates for other sea walls were also presented, but they are not deemed of as pressing importance as this one.

July 1, 1892, balance unexpended	$5,000.00
Amount transferred to allotment for sea wall at Governors Island, New York	4,000.00
July 1, 1893, balance unexpended	1,000.00
Amount (estimated) required for completion of existing project	55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00

(See Appendix 5 A.)

SEA WALLS AT GOVERNORS ISLAND, NEW YORK HARBOR.

Officers of the Corps of Engineers in charge: Col. D. C. Houston, until May 18, 1893; Lieut. Col. H. M. Robert, since June 12, 1893, and First Lieut. T. H. Rees has been under the immediate orders of Col. Houston and Lieut. Col. Robert since April 5, 1893, except from May 18 to June 12, during which period he was temporarily in charge of work.

The project adopted in 1865 provided for inclosing the entire island by a sea wall. Under an allotment made in 1865 and other subsequent allotments and appropriations walls were built on the south, southeast, east, northwest, and west sides of the island, the latter being completed in March, 1892.

During the past fiscal year 397.35 linear feet of wall was built on the east side of the island to connect the previously built wall with the stone wharf. This completes the inclosure of the entire island. Riprap has also been purchased to protect the foundations of the sea walls, the masonry joints have been pointed, and a part of the embankment back of the north wall has been graded and sodded.

With the available funds additional riprap will be placed about the foundations, the pointing will be completed and the embankment close to the walls will be put in order.

This will complete the project for sea walls at this place and no further appropriations will be required at present.

July 1, 1892, balance unexpended		$13,854.14
Transferred from allotment for sea wall at Davids Island, New York		4,000.00
		17,854.14
June 30, 1893, amount expended during fiscal year		11,222.15
July 1, 1893, balance unexpended		6,631.99
July 1, 1893, outstanding liabilities	$1,789.00	
July 1, 1893, amount covered by uncompleted contracts	3,434.00	
		5,223.00
July 1, 1893, balance available		1,408.99

(See Appendix 5 B.)

WATER SUPPLY AND SEWERAGE SYSTEM AT FORT MONROE, VIRGINIA.

Officer in charge, Maj. Charles E. L. B. Davis, Corps of Engineers, with Lieut. George A. Zinn, Corps of Engineers, under his immediate orders; Division Engineer, Col. William P. Craighill, Corps of Engineers.

Water supply.—The supply of water is dependent upon rain water stored in cisterns and water of inferior quality brought across Mill Creek in iron pipes. The importance of an adequate supply of wholesome water within the limits of the fortification can hardly be overestimated. Six thousand dollars was appropriated by the act of February 24, 1891, but this amount was not deemed sufficient to sink a well to the depth which it is already shown must be exceeded to secure a supply of good water. A brief account of previous attempts at sinking artesian wells at this post and a résumé of information collected during the fiscal year are given in the report of the local officer, who recommends that an additional appropriation of $14,000 be made.

July 1, 1892, balance unexpended	$6,000.00
July 1, 1893, balance unexpended	6,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00

(See Appendix 6 A.)

Sewerage system.—Twenty-five thousand dollars was appropriated by the act of March 2, 1889, for a complete system of sewerage inside and outside of the fort.. Bids received for this work showed that the appropriation was insufficient for the purpose. October 29, 1891, the Secretary of War decided that two separate systems must be constructed, one by the United States and the other by the hotel proprietors and others enjoying the privilege of residence on the reservation. Estimates in accordance with this decision of the Secretary of War were submitted March 12, 1892, amounting to $45,000, and it was recommended that an appropriation of that sum be made for the sewerage system in lieu of the amount appropriated by the act of March 2, 1889. The numerous reports of the local officer in charge and of the commanding officers and post surgeons show the great and urgent need of this improvement.

During the fiscal year ending June 30, 1893, the subject of the sewerage of Fort Monroe, on account of the apprehended danger of a cholera epidemic, came up prominently, and a very voluminous official correspondence resulted therefrom, a résumé of which will be found in the report of the local officer.

September 28, 1892, the Secretary of War directed that a plan for the *entire* sewerage of the reservation, including military and nonmilitary residents, be submitted as soon as practicable, with estimates of cost of construction and schedules of distribution of cost and expense of running and maintenance. October 26, 1892, a plan was submitted for a joint system of sewerage for the entire reservation, at a total estimated cost of $75,000, with suggested regulations for the use of the system, estimated cost of maintenance and the draft of a bill for the preservation, repair, and maintenance of the system, with a project for apportioning the cost based upon the number of occupants of the various buildings. Owing to the failure of Congress to appropriate any additional money or to authorize by legislation the Secretary of War to assess the nonmilitary residents for their share of the cost of constructing a system, no work has been done, nor can any be attempted.

July 1, 1892, balance unexpended	$24,902.10
July 1, 1893, balance unexpended	24,902.10
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895.	75,000.00

(See Appendix 6 B.)

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1894–'95.

For construction of gun and mortar batteries	$1,629,126
For construction of gun and mortar platforms	264,000
For purchase of land for fortifications	500,000
For protection, preservation, and repair of fortifications	85,000
For preparation of plans for fortifications	5,000
For protection of site of Fort Niagara, N. Y.	10,000
For sea walls and embankments	34,300
For artesian well at Fort Monroe, Va	14,000
For construction of sewerage system at Fort Monroe, Va	50,000
For purchase of submarine mines and necessary appliances to operate them for closing the channels leading to our principal seaports	51,550
For needful casemates, cable galleries, etc., from which to operate submarine mines	50,000
	2,692,976

THE BOARD OF ENGINEERS.

The Board, as at present constituted, consists of the following officers of the Corps of Engineers: Col. Henry L. Abbot, Col C. B. Comstock, Lieut. Col. Henry M. Robert, and Lieut. Col. G. L. Gillespie.

The late Col. D. C. Houston served as a member of the Board to the date of his decease, May 18, 1893. He was replaced by Lieut Col. Robert.

Col. G. H. Mendell, Corps of Engineers, is also a member of the Board when it is acting upon matters pertaining to defensive works on the Pacific coast; and Col. W. P. Craighill, Corps of Engineers, is a member of the Board while it is considering a project for the defense of Baltimore, Md.

The Board has considered the various subjects referred to it during the past year by the Chief of Engineers, and the following is a brief summary of the reports rendered thereon:

1892, July 25. On angles of elevation and azimuth for 8, 10, and 12-inch casemate carriages.

July 27. On the defense of Tybee Roads and the entrance of Savannah River.

August 5. On questions bearing on the improvement of the Harlem River inclosed by the Committee on Commerce, U. S. Senate, to the Secretary of War, June 30, 1892.

August 21. On design of Oliver W. Johnson for a turtle-back fort.

August 30. On estimate of Lieut. Col. P. C. Hains, Corps of Engineers, dated August 22, 1892, for the construction of a battery at Portland Head, Me.

August 30. On project of Maj. W. A. Jones, Corps of Engineers, dated August 8, 1892, for a navigable pass through Sand Lake Dam.

September 13. On plans of Lieut. Col. G. L. Gillespie, Corps of Engineers, for the construction of two counterscarp galleries for ditch defense of mortar battery at Sandy Hook, N. J.

September 24. On working drawings of Capt. W. H. Bixby, Corps of Engineers, for casemate and cable galleries for defense of Dutch Island Harbor, Rhode Island.

October 13. On plan of Lieut. J. G. Warren, Corps of Engineers, for construction of turntables to facilitate the handling of ammunition at Sandy Hook, N. J.

October 13. Recommending three sites at which available balances should be applied for mining casemates and their galleries.

October 18. Investigation and report on the subject of the storage of explosives in barges in New York Harbor.

October 19. On plans of the East River Bridge Company for construction of two bridges over the East River, New York.

October 20. Submitting working drawings of a platform for 12-inch mortars suited to receive the new spring-return carriage.

October 28. On the defense of Narragansett Bay.

November 5. On the application of the East River Bridge Company for the construction of two bridges across East River, New York.

November 12. On working drawings of Lieut. Col. S. M. Mansfield, Corps of Engineers, for constructing emplacement for battery at Long Island Head, Boston, Mass.

November 26. On retention of United States land in San Juan County, Washington, for military purposes.

November 28. On metal for hold-down bolts for use in platforms for 12-inch mortars.

December 2. On report and estimates of Maj. T. H. Handbury, Corps of Engineers, for making surveys and maps of sites for defenses on the Pacific coast.

December 15. On an application for a lease of a portion of La Costa Island on the Gulf coast of Florida.

December 15. Drawings and estimates of emplacements for two 8 or 10-inch guns for the defense of New Orleans, La.

December 17. On paper of Capt. J. G. D. Knight, Corps of Engineers, relative to thickness of cover to resist projectiles.

December 30. On modification by Lieut. Col. P. C. Hains, Corps of Engineers, of his project for a breakwater from Mount Desert to Porcupine Island, Maine.

1893, February 27. Recommending localities at which six mining casemates and their cable galleries should be built.

March 3. On mining casemates at Great Hog Island, Maine.

April 29, May 9. On exact locations for mining casemates at Mobile, Ala., and Pensacola, Fla.

April 29. On the need of Martello towers at Fort Taylor, Key West, Fla., for defensive purposes.

April 29. On the defense of Charleston, S. C.

June 3. On sites for an 8-inch gun on a nondisappearing carriage, and for a 12-inch mortar at Fort Monroe, Va.

June 22. On sites for fortifications on Cushings Island, Portland Harbor, Maine, and the boundary of land to be acquired for such sites.

June 22. On the defense of Pensacola, Fla.

In the performance of the duties of the Board the following personal examinations were made:

1. Under the orders of the Chief of Engineers, dated February 7, 1893, the Board made an inspection of the defenses of Pensacola, Fla., and Mobile, Ala., on April 5 and 6, 1893, respectively.

2. In accordance with instructions contained in indorsement of the Chief of Engineers, dated February 25, 1893, a committee of the Board, consisting of Col. Henry L. Abbot and Lieut. Col. G. L. Gillespie, Corps of Engineers, accompanied by Capt. J. G. D. Knight, Corps of Engineers, made an inspection of Cushings Island, Portland, Me., on May 19, 1893, with a view to define the limits of the site to be purchased and the exact location of the proposed batteries.

3. Under the order of the Chief of Engineers, dated March 8, 1893, Cols. Abbot, Craighill, and Comstock, and Lieut. Col. Gillespie made an inspection of the defenses of Baltimore, Md., on June 13, 1893.

In addition to their duties with The Board of Engineers, the individual members of the Board have been otherwise engaged as follows:

1. Col. Henry L. Abbot, the president of the Board, concluded his duties in charge of certain experiments with torpedoes; and, as a member of the boards to fix harbor lines for the ports of Boston, Mass., and Oswego, N. Y., and to test the working mechanism of a 12-inch gun lift constructed at Sandy Hook, N. J. He has continued as Division Engineer of the Northeast Division; as president of the board to establish harbor lines for the harbor of New York and its adjacent waters, and as a member of the Board of Ordnance and Fortification. He has also served as president of a board for the examination of officers of the Corps of Engineers, with a view to promotion; and under

instructions from the Chief of Engineers, dated July 30, 1892, has inspected the engineering works in charge of Lieut. Cols. Hains, Gillespie, Smith, Mansfield, and King, as well as those of the six district officers of the Northeast Division.

2. Col. C. B. Comstock has served as Division Engineer of the Southwest Division; as member of the Board of Visitors to the U. S. Engineer School; as president of the Mississippi River Commission; as member of the board to establish harbor lines for the harbor of New York and its adjacent waters; as member of the board to establish harbor lines for the port of Philadelphia; as a member of a board for the examination of officers of the Corps of Engineers with a view to promotion, and as member of a board of engineer officers on the improvement of the Ohio River at Logstown Bar. He also represented the War Department at the Fifth International Congress of Internal Navigation at Paris, France.

3. Lieut. Col. Henry M. Robert became a member of The Board of Engineers June 12, 1893, under the provisions of paragraph 8, Special Orders No. 124, Headquarters of the Army, Adjutant-General's Office, June 2, 1893, and is the disbursing officer of the Board. He has conducted the various works of river and harbor improvement and of fortifications under his charge, and is a member of the Board of Visitors to the U. S. Engineer School, and of the boards to consider and report upon the harbor lines for New York Harbor and its adjacent waters, and Stamford Harbor, Conn. He also served as a member of the board of engineer officers to consider and report upon the proposed deep-water harbor at San Pedro or Santa Monica Bay, and exercised supervision over the construction of bridges across the Tennessee River at or near Knoxville, and at Johnsonville, Tenn.

4. Lieut. Col. G. L. Gillespie, in addition to conducting the various works of river and harbor improvement and of harbor defense, with which he was charged during the year, has continued to serve as a member of the Board of Visitors to the U. S. Engineer School, and as a member of the harbor line boards for the harbors of New York, and Stamford, Bridgeport, and Norwalk, Conn. He also served as disbursing officer of The Board of Engineers and as a member of the board of engineer officers to test the working mechanism of a 12-inch gun lift constructed at Sandy Hook, N. Y.

POST OF WILLETS POINT, N. Y.—UNITED STATES ENGINEER SCHOOL—BATTALION OF ENGINEERS—ENGINEER DEPOT.

Officer in command, Lieut. Col. W. R. King, Corps of Engineers.

POST OF WILLETS POINT, NEW YORK.

At the close of the fiscal year, the garrison consisted of 21 commissioned officers and 335 enlisted men, including officers and noncomissioned officers of the general staff, student officers, and enlisted men of the Hospital Corps. This is a loss of 3 officers and 18 enlisted men in strength over last year's report.

During the year repairs and improvements have been made to roads, sidewalks, buildings, and sewerage.

The new guardhouse and repairs to quartermaster's wharf have been completed, the two barrack buildings are nearing completion, and a third has been authorized.

The most important improvements still unprovided for are a quartermaster and commissary storehouse near the wharf, the cleaning out of the ditch bounding the Government lands on the southwest, the walling in of the ice pond, and the lighting of the post by electricity.

The drill, discipline, instruction, and sanitary condition of the garrison have been satisfactory and compare favorably with the attainments of former years as shown by the comparative statement in Appendix.

UNITED STATES ENGINEER SCHOOL.

During the year, 4 engineer officers and 7 infantry officers completed the course, and 1 cavalry, 2 artillery, and 1 infantry officer, who have completed the laboratory duty, are still engaged in the practice work of planting and operating torpedoes, which will be completed October 1, 1893.

All have manifested intelligence and interest in the work and are entitled to certificates of proficiency in one or more of the branches they have been studying and practicing.

BATTALION OF ENGINEERS.

The legal strength of the Battalion of Engineers is 5 companies of 150 men each, with a sergeant-major and a quartermaster-sergeant, and is officered by details from the commissioned officers of the corps.

The present strength is 18 officers and 418 enlisted men.

The authorized strength of companies A, B, and C, which are stationed at Willets Point, is 133 men each, and of Company E, stationed at West Point, N. Y., 100 men.

The total losses from all causes during the year have been 154, and the total gain 135, making a loss of 19 men.

The battalion has been employed during the year at engineer, pontoon and torpedo drills, infantry drills, rifle practice, photography, and Company E, at West Point, has assisted in the instruction of cadets in military engineering and pontoon drill.

ENGINEER DEPOT.

The fireproof storehouse referred to in last report has been completed and occupied with pontoon, siege, and torpedo materials and appliances. It is recommended that the balance of the appropriation for this building, $2,931.21, be applied to the establishment of an electric-light plant, for lighting the public buildings, using such surplus machinery and materials as are now available and suitable for the purpose.

The small steam tug built for planting torpedoes has been completed and fitted out with the necessary hoisting machinery and tackle, and is now in use.

An additional concrete tank for storing torpedo cable has been completed, ready for the reception of the new supply of cable recently contracted for.

The depot property, such as astronomical and surveying instruments, pontoon, siege, and torpedo materials, has been cared for and the purchases, receipts, and issues have been made in the usual manner.

Experiments have been continued with the Sims-Edison torpedo, and tests have been made of explosives, building materials, etc.

STATEMENT OF FUNDS.

Congress has at various times appropriated as follows:

1. For engineer depot at Willets Point, N. Y., for the fiscal year ending June 30, 1893, the amount of	$15,000.00
Expended and pledged	15,000.00
2. For engineer depot at Willets Point, N. Y. (no limit), for fireproof storehouse, the amount of	16,000.00
July 1, 1893, balance available	2,931.21
3. For torpedoes for harbor defense, act September 22, 1888:	
July 1, 1892, balance unexpended	5,088.33
July 1, 1893, balance available	5,000.00
4. For torpedoes for harbor defense, act March 2, 1889:	
July 1, 1892, balance unexpended	54,875.45
July 1, 1893, balance available	16,589.27
5. For torpedoes for harbor defense, act of August 18, 1890:	
July 1, 1892, balance unexpended	26,736.35
July 1, 1893, balance available	24,598.85
6. For torpedoes for harbor defense, act February 24, 1891:	
July 1, 1892, balance unexpended	833.70
July 1, 1893, balance available	83.70
7. For torpedoes for harbor defense, acts March 2, 1889, and August 18, 1890 (reallotment for purchase of submarine cable):	
July 1, 1892, balance unexpended	74,961.12
July 1, 1893, balance available	32,440.52
8. For engineer depot at Willets Point, N. Y., for the fiscal year ending June 30, 1894	11,000.00

There will be required for the fiscal year ending June 30, 1895, for the engineer depot at Willets Point, N. Y., the following, viz:

1. For incidental expenses of depot	$5,000.00
2. For purchase of materials for instruction of battalion	3,500.00
3. For purchase and repair of instruments	3,000.00
4. For purchase and binding of professional works for library	500.00
Total	12,000.00

(See Appendix No. 7.)

RIVER AND HARBOR IMPROVEMENTS.

The funds with which the works for the improvement of rivers and harbors were prosecuted during the last fiscal year were derived from the appropriations by the river and harbor act approved July 13, 1892, and appropriations in the sundry civil acts approved August 5, 1892, and March 3, 1893, for certain works on account of which contracts were to be made for completion as provided in the acts of September 19, 1890, and July 13, 1892, and such balances of former appropriations as were available.

A brief statement derived from the reports of the officers in charge of the several works hereinafter given sets forth the condition of each improvement, the extent of work performed during the last fiscal year, the amount expended, and estimate of amount required for its completion.

Section 2 of the river and harbor act approved March 2, 1867, requires that the Secretary of War shall annually submit to Congress a full estimate for the entire and permanent completion of each river and harbor work, and of the amount that can be profitably expended on each uncompleted work in the next fiscal year.

Reports are appended of the work accomplished in the removal of wrecks obstructing or endangering navigation, as provided for in section 4 of the river and harbor act approved June 14, 1880, and enlarged by provision in the river and harbor act of August 2, 1882.

Under the authority given to the Secretary of War in section 12 of the river and harbor act approved September 19, 1890, harbor lines have been established at localities indicated further on in this report.

Examinations were made, whenever required by the committees of Congress, of proposed bills authorizing the construction of bridges upon which the views of the War Department were desired. Of the bills so examined, 18 originated in the Senate and 32 in the House of Representatives.

During the fiscal year examinations were made of such plans and locations as were submitted by parties interested of bridges proposed to be built over navigable waters subject to the approval of the Secretary of War, as authorized by acts of Congress. A brief statement is given of the action had in such cases.

Under sections 4 and 5 of the river and harbor act approved September 19, 1890, persons, corporations, or associations owning or controlling bridges over navigable waterways of the United States, which are unreasonable obstructions to the free navigation of such waters, after being given a reasonable opportunity to be heard, have been notified to so alter the bridges as to render navigation through or under them reasonably free, easy, and unobstructed. In each case the changes required to be made were specified in the notice, and reasonable time was prescribed in which to make them. A detailed statement of the cases is given further on in this report.

Reports made in compliance with the requirements of section 2 of the river and harbor act of July 5, 1884, and section 4 of that of August 5, 1886, of instances in which piers, breakwaters, or other works built by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual, will be found in Appendix A A A.

The engineering works in the charge of this office are arranged in five divisions, and officers of the corps assigned as division engineers to overlook the works, as follows:

West of the Rocky Mountains: Pacific Division, Col. George H. Mendell. East of the Rocky Mountains: Northeast Division, Col. Henry L. Abbot; Southeast Division, Col. Wm. P. Craighill; Southwest Division, Col. Cyrus B. Comstock; Northwest Division, Col. Orlando M. Poe.

South Pass of the Mississippi River.—During the fiscal year ending June 30, 1893, the legal channel was maintained through the jetties at the mouth of the Pass; but during a period of twenty-six days (May 27 to June 20, inclusive, and June 30) such channel did not obtain through the Pass itself, and for 14 days (June 5 to June 18, inclusive) such channel did not exist through the shoal at the head of South Pass.

Rules and regulations for the use of canals.—The act of Congress approved September 26, 1888, authorized the Secretary of War to prescribe proper rules and regulations for the administration, and use by the public, of the Des Moines Rapids Canal, the St. Marys Falls Canal, the Louisville and Portland Canal, and the St. Clair Flats Canal, and provided penalties for willful violation of such rules. Similar legislation was enacted by acts of August 11, 1888, and September 19, 1890, applying to the South Pass of the Mississippi River and the Des Moines Rapids Dry Dock.

It is desirable that similar authority should be granted to the Secretary of War with respect to all the canals owned and operated by the Government, and that the willful violation of such rules as may be prescribed should be declared a misdemeanor, and penalties therefor be provided. The need of rules to govern the use and navigation of these

works, and of adequate provision for their enforcement, applies alike to all the canals. Express legislation in some cases indicates that Congressional action is necessary in all cases for the sufficient and proper enforcement of whatever rules the Secretary of War may promulgate, and difficulty has already arisen from the lack of authority to enforce rules and regulations prescribed for the use of canals not embraced in existing enactments.

The following draft of an act similar in its provisions to the acts above referred to, and applying to all United States canals and similar works of navigation, is proposed and urgently recommended for passage by Congress:

AN ACT providing for the establishment and enforcement of rules and regulations for the use and navigation of United States canals and similar works of navigation.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be the duty of the Secretary of War to prescribe such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are, or that hereafter may be, owned, operated, or maintained by the United States as in his judgment the public necessity may require.

SEC. 2. That such rules and regulations shall be posted, in conspicuous and appropriate places, for the information of the public; and every person and every corporation which shall knowingly and willfully violate such rules and regulations, shall be deemed guilty of a misdemeanor, and on conviction thereof, in any district court in the United States within whose territorial jurisdiction such offense may have been committed, shall be punished by a fine not exceeding five hundred dollars, or by imprisonment (in the case of a natural person) not exceeding six months, in the discretion of the court.

ATLANTIC COAST AND GULF OF MEXICO.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

This district was in the charge of Lieut. Col. Peter C. Hains, Corps of Engineers.

1. St. Croix River, Maine.—An examination and survey of the St. Croix River were made under the provisions of the river and harbor act of August 11, 1888, and the reports on same were published in the Annual Report of the Chief of Engineers for 1890 (page 463). The available depth, at mean low water, over the shoals was found to be from 6.5 to 9.5 feet, and in the upper part of the harbor, at Calais, but 1.5 feet. The channel was also narrow. In the report on the survey it was proposed to obtain a channel 12 feet deep at mean low water, with a general width of 200 feet, but narrowed to 150 and 100 feet at the upper end. Such an improvement would enable steamboats to reach landings at the upper end of the harbor, and would allow large lumber vessels to fully load at the wharves instead of having to drop downstream about 4 miles to complete their cargoes.

An appropriation of $35,000 was made by act approved September 19, 1890, coupled with the proviso "that the government of the Dominion of Canada shall expend a like sum in the improvement of said river."

No work has yet been done, pending action by the Dominion government, and none of the appropriation has been expended.

July 1, 1892, balance unexpended	$35,000.00
July 1, 1893, balance unexpended	35,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	245,000.00

(See Appendix A 1.)

2. Lubec Channel, Maine.—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Dominion of Canada.

Originally the channel was but 5 feet in depth at mean low water, and but 2 feet at low water of spring tides.

The project, adopted in 1879, and subsequently modified, was for a channel 275 feet wide, 300 feet wide in the bends, and 12 feet deep at mean low water.

The expenditures to June 30, 1892, amounted to $168,954.42.

There were no expenditures during the fiscal year just ended.

At the close of the fiscal year 1891 the project had been practically completed, and no work has been done since.

Under the provisions of the river and harbor act of September 19, 1890, an examination of Lubec Channel was made, and the report was published in the Annual Report of the Chief of Engineers for 1891 (page 616).

July 1, 1892, balance unexpended	$45.58
July 1, 1893, balance unexpended	45.58

(See Appendix A 2.)

3. Moosabec Bar, Maine.—Before the improvement was commenced the entrance at the eastern end of Moosabec Reach was difficult, the channel being crooked, with ledges on either hand. The direct entrance was obstructed by a bar on which the depth was only about 6 feet at mean low water.

The project, adopted in 1881, provided for a channel 14 feet deep at mean low water, and not less than 200 feet wide, through the bar at the eastern entrance to the reach. In 1888 the project was extended to provide for widening the 14-foot channel to 300 feet, for removal of ledges obstructing the channel, and for the construction of a small breakwater to divert cross currents.

The expenditures to June 30, 1892, were $60,418.77. At the latter date the 300-foot channel had been completed to the full projected width and depth, the breakwater had been built, and a small quantity of ledge had been removed.

The expenditures during the past year amounted to $374.88. A contract was made December 23, 1892, for excavating ledge obstructing the western approach to the dredged channel. The depth over the ledge is to be made 16 feet at mean low tide, and the present contract covers the excavation of about 1,000 cubic yards, measured in place. The contractor began work about the 1st of June, 1893; at the close of the fiscal year 1893 the work was not sufficiently advanced to be of practical benefit to commerce.

The benefits derived from the improvement are not local, the thoroughfare being extensively used by coastwise vessels, both as a harbor of refuge and as a sheltered route.

July 1, 1892, balance unexpended		$9,581.23
Amount appropriated by act approved July 13, 1892		15,000.00
		24,581.23
June 30, 1893, amount expended during fiscal year		374.88
July 1, 1893, balance unexpended		24,206.35
July 1, 1893, outstanding liabilities	$150.00	
July 1, 1893, amount covered by uncompleted contracts	13,363.35	
		13,513.35
July 1, 1893, balance available		10,693.00

Amount (estimated) required for completion of existing project	$65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 3.)

4. Narraguagus River, Maine.—The obstruction to navigation consisted in a bar at the mouth of the river, over which there was a navigable depth of less than 6 feet at mean low water, and less than 4 feet at extreme low water.

The project for improvement is to dredge a channel not less than 200 feet wide, having 11 feet depth at mean low water from the deep water of the bay to Long Point, and a depth of 9 feet from thence to the anchorage.

The expenditures to June 30, 1892, amounted to $27,463.42.

At the latter date there had been dredged an 11-foot channel from the deep water in the bay in toward the new steamboat wharf, 90 feet wide, with a space in front of the wharf 300 feet wide. From the new steamboat wharf to the old one near Long Point the channel was 100 feet wide, with a turning basin in front of the old wharf 300 feet wide.

The expenditures during the fiscal year ending June 30, 1893, amounted to $80.30. No work was in progress during the year. Proposals for dredging were opened October 3, 1892, and again November 16, 1892, but each time all bids were rejected, the prices being high. The work will be again advertised.

July 1, 1892, balance unexpended	$36.58
Amount appropriated by act approved July 13, 1892	7,500.00
	7,536.58
June 30, 1893, amount expended during fiscal year	80.30
July 1, 1893, balance unexpended	7,456.28

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 4.)

5. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.—The anchorage in front of the town of Bar Harbor, as well as the wharves at which steamers land, is exposed to storms and seas from southerly directions, at times rendering the anchorage insecure, and the landing of passengers and freight at the wharves difficult.

The original project was to construct a riprap breakwater in a direct line from Porcupine Island to Dry Ledge, and thence to within a short distance of Mount Desert Island. The direction of that portion west of Dry Ledge was afterward slightly changed, so that the westerly end of the breakwater would be somewhat farther to the southward. In January, 1893, the project was again amended, and now provides for a breakwater on the direct line first proposed, but somewhat shorter, terminating at a distance of about 600 feet from the low-water line on Mount Desert Island, reducing the estimated cost to somewhat more than one-half that of the project of 1890, but answering all needful requirements.

The expenditures up to the close of the fiscal year ending June 30, 1892, amounted to $34,205.37. At that date 30,473 tons of stone had been deposited in that part of the breakwater between Porcupine Island and Dry Ledge.

The expenditures during the fiscal year just ended were $19,930.55. As a result that part of the work between Porcupine Island and Dry Ledge has been completed. Work was commenced on the part west of Dry Ledge, and 9,921 tons of stone has been deposited.

It is reported by masters of vessels that the work thus far done has been of great benefit.

July 1, 1892, balance unexpended		$65,794.63
Amount appropriated by act approved July 13, 1892		50,000.00
		115,794.63
June 30, 1893, amount expended during fiscal year		19,330.55
July 1, 1893, balance unexpended		96,464.08
July 1, 1893, outstanding liabilities	$636.05	
July 1, 1893, amount covered by uncompleted contracts	46,639.50	
		47,275.55
July 1, 1893, balance available		49,188.53

Amount (estimated) required for completion of existing project	270,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 5.)

6. Bagaduce River, Maine.—The Bagaduce is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay, and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres in area, the bottom of which for the greater part is bare at low tide. There is a narrow channel that runs from Bridges Point to Bowdens Wharf, which has a depth of less than 2 feet and is obstructed by ledges near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. A project for the improvement of the Northern Bay was adopted in 1890, which has for its object the securing of a channel 100 feet wide and 6 feet deep at mean low tide, from Bridges Point to Bowdens Wharf, at an estimated cost of $45,000. It is also intended to remove a small quantity of rock obstructing the southern channel at Johnsons Narrows, at an estimated cost of $1,875.

The expenditures to the close of the fiscal year ending June 30, 1892, amounted to $100, which were for preparation of plans, etc. No work had been done, the amount available at that date not being sufficient to accomplish enough to be of any material benefit.

The expenditures during the year ending June 30, 1893, were $119.72, making the total expenditures $219.72. A contract was made in January, 1893, for dredging a channel 6 feet deep at mean low tide, and 40 feet wide, from Bridges Point to Bowdens Wharf, removing all material except ledge, the work to be done during the present season.

July 1, 1892, balance unexpended	$6,900.00
Amount appropriated by act approved July 13, 1892	5,000.00
	11,900.00
June 30, 1893, amount expended during fiscal year	119.72
July 1, 1893, balance unexpended	11,780.28
July 1, 1893, amount covered by uncompleted contracts	10,500.00
July 1, 1893, balance available	1,280.28

Amount (estimated) required for completion of existing project	$34,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 6.)

7. *Penobscot River, Maine.*—The improvement of the Penobscot River was first undertaken in 1870, the project being for a channel not less than 150 feet wide, 12 feet deep at low tide, as far up as Bangor. At that time the channel was shoal and dangerous.

At Bangor the depth did not exceed about 6 feet at lowest stages, and navigation was obstructed by numerous rocks and ledges. The work was continued until 1880, and included also the removal of obstructions in the harbor at Bangor and at Bucksport, the expenditures aggregating $198,000. No further work was done until 1884, when a project was adopted for widening the channel at Bangor and for certain improvements in the river below near Crosbys Narrows, at an estimated cost of $75,000. While this work was in progress a survey was made, under the river and harbor act of 1886, from Bangor to Bucksport Narrows, and a project was submitted for securing a 22-foot depth between Bucksport and Winterport at an estimated cost of $365,000, making the combined cost of the two projects $440,000. The act of September 19, 1890, appropriated $25,000 and provided for dredging near Sterns Mill.

Another survey was ordered by the act of September 19, 1890, which was made, and the report published in the Annual Report of the Chief of Engineers for 1892 (pages 533–540).

The general project under which the improvement of the Penobscot River is now being carried on may be stated as follows: To widen the channel at Bangor to 360 feet, and a depth of 11 feet at extreme low water; to widen, straighten, and deepen the channel near Crosbys Narrows and near Sterns Mill to a depth of 12 feet at extreme low tide; and to secure a channel depth of 22 feet at mean low tide between Bucksport and Winterport, the estimated cost of the entire work being $440,000.

This estimate includes the cost of the jetties at Frankfort Flats and High Head, in order to contract the waterway should such contraction be necessary. It is thought, however, that as the deposit of sawdust and mill waste into the river has in a large measure been stopped, and as the channels at these places were obstructed chiefly by this material, the contraction works may not be necessary. The channel at Frankfort Flats was dredged in 1890 to 22 feet, and while it has in some places filled in there is still an available channel of that depth through it. The channel at High Head has deepened from natural causes, so that the available depth through it at the time of the last examination, about a year ago, had increased to about 21 feet. Under the circumstances it does not seem advisable to construct any contraction works, certainly not until it is definitely ascertained that such works are necessary.

Further examinations will be made of these channels.

For the present no additional appropriation is recommended for the Penobscot River.

The appropriations up to the close of the fiscal year ending June 30, 1892, aggregated $308,300, and the expenditures under the various projects to the same date amounted to $284,332.87. The results were the widening and deepening of the channel at Bangor from a depth of 6 feet at extreme low tide to 12 feet; the removal of rocks, ledges, and

other obstructions; the removal of a shoal near Bucksport; and a general increase in depth and width of channels from the mouth up to Bangor.

The expenditures during the fiscal year ending June 30, 1893, amounted to $18,177.58. The contract for dredging at and near Sterns Mill, which was in progress at the close of the fiscal year 1892, was completed in the following November, the total quantity of material excavated being 61,460 cubic yards.

A contract was made in February, 1893, for widening the Bangor channel 60 feet, to the full projected width of 360 feet. This work is now in progress, having been commenced early in June, 1893.

July 1, 1892, balance unexpended		$23,967.13
Amount appropriated by act approved July 13, 1892		40,000.00
		63,967.13
June 30, 1893, amount expended during fiscal year		18,177.58
July 1, 1893, balance unexpended		45,789.55
July 1, 1893, outstanding liabilities	$300.00	
July 1, 1893, amount covered by uncompleted contracts	14,720.00	
		15,020.00
July 1, 1893, balance available		30,769.55
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		290,000.00

(See Appendix A 7.)

8. Belfast Harbor, Maine.—Originally the harbor was not deep enough to accommodate the commerce. At one place in the harbor the depth was only about 4 feet at mean low tide.

In 1876, a project for dredging was adopted, and the work was completed in 1879, at a cost of $22,000. No more work was done until 1890, when a new project was adopted by which it was proposed to dredge a channel 250 to 300 feet wide, and 15 feet deep at mean low tide, from the deep water at the entrance to the upper harbor; to dredge an area on the north side of the harbor to a depth of 8 feet; and to dredge an area on the south side of the channel to a depth of 13 feet.

The total expenditures up to June 30, 1892, were $35,000. At that date the 8-foot dredging had been completed, leaving the 13-foot and 15-foot dredging yet to be done.

The expenditures during the last fiscal year were $26.05. A contract was made in October, 1892, for dredging the channel of entrance to the depth of 15 feet at mean low tide. Work was commenced during the early part of June, 1893, and is now in progress.

Amount appropriated by act approved July 13, 1892		$10,000.00
June 30, 1893, amount expended during fiscal year		26.05
July 1, 1893, balance unexpended		9,973.95
July 1, 1893, outstanding liabilities	$200.00	
July 1, 1893, amount covered by uncompleted contracts	9,200.00	
		9,400.00
July 1, 1893, balance available		573.95
Amount (estimated) required for completion of existing project		32,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		32,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 8.)

9. Camden Harbor, Maine.—Before the improvement was commenced vessels drawing more than 6 feet could not reach the wharves at low tide.

The improvement projected is to dredge an area at the eastern part of the entrance to a depth of 12 feet at mean low tide; to dredge a channel on each side of the harbor, and the approach to the same, to a depth of 10 feet at mean low tide; to dredge small channels at the upper end of the harbor to a depth of 5 feet at mean low tide; and, after completion of the above items, to dredge the middle ground of the harbor to the same depths as the adjacent channels.

The expenditures under the present project, to the close of the fiscal year ending June 30, 1892, were $11,000. As a result the western channel had been dredged to a depth of 10 feet at mean low tide throughout its entire length, including the approach, the latter to a width of 125 feet, and the channel itself to a width of 100 feet.

The expenditures during the last fiscal year were $41.93. No work was in progress. A contract for dredging was made December 17, 1892, the work to be done during the latter part of the present season.

Amount appropriated by act approved July 13, 1892	$12,000.00
June 30, 1893, amount expended during fiscal year	41.93
July 1, 1893, balance unexpended	11,958.07
July 1, 1893, amount covered by uncompleted projects	11,000.00
July 1, 1893, balance available	958.07
Amount (estimated) required for completion of existing project	37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	37,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 9.)

10. Rockland Harbor, Maine.—The location of Rockland Harbor is such that, besides accommodating its own commerce, it affords a convenient refuge for large numbers of coasting vessels. When the project for a breakwater was adopted the harbor was open to easterly storms, the anchorage was unsafe, and the seas often broke over the wharves.

The project as originally adopted in 1881 provided for two breakwaters, one starting from southwest ledge in the harbor, and running in a northerly direction toward Jameson Point, a distance of 2,640 feet, the other starting from Jameson Point, and extending southward about 1,900 feet. The estimated cost was $550,000. The top of each breakwater was to be only 5 feet above the level of mean low tide.

In 1887 the project was amended so as to bring the top of the breakwater from Jameson Point to the level of high tide, leaving the other as originally designed. The estimated cost was thus increased to $650,000.

In 1890 the project was again modified. Instead of building the second breakwater from Southwest Ledge in a northerly direction, on which no work had been done, it was decided to prolong the one from Jameson Point in a southerly direction. By doing so, a much larger area of the harbor would secure protection. The estimated cost of the new project was $632,500, this being inclusive of the part already constructed.

Up to the close of the fiscal year ending June 30, 1892, there had been expended on the breakwater the sum of $169,385.48, and about 180,000 tons of stone had been placed in position.

The above expenditures had resulted in protecting a part of the harbor, giving a secure harbor of refuge for many vessels that trade near this port.

During the fiscal year ending June 30, 1893, the expenditures were $29,750.97. At the close of the fiscal year 1892 work on the breakwater was in progress under a contract with William S. White, of Rockland, Me. This contract was completed in November, 1892. At that date the breakwater had been practically completed to a point about 2,215 feet from the shore. In December, 1892, a contract was made involving the expenditure of the appropriation of July 13, 1892, for continuing the construction of the breakwater. The work was in progress at the close of the fiscal year 1893, about 23,460 tons of stone having been deposited. The price is 73 cents per ton of 2,000 pounds of stone, deposited in place.

An examination of Rockland Harbor, under the provisions of act of Congress of July 13, 1892, was made and report thereon submitted August 17, 1892. (See below, page 37.)

July 1, 1892, balance unexpended		$20,614.52
Amount appropriated by act approved July 13, 1892		30,000.00
		50,614.52
June 30, 1893, amount expended during fiscal year		29,750.97
July 1, 1893, balance unexpended		20,863.55
July 1, 1893, outstanding liabilities	$1,330.91	
July 1, 1893, amount covered by uncompleted contracts	15,240.94	
		16,571.85
July 1, 1893, balance available		4,291.70
Amount (estimated) required for completion of existing project		412,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 10.)

11. Kennebec River, Maine.—Before the improvements were commenced the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef Rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (Hatchs Rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles, was obstructed by shoals which gave only a navigable depth of 3½ feet of water in low summer tides.

Appropriations were made at various times between 1827 and 1852 for improving the river, but the first regular project was adopted only in 1866, and was for removing rocks and straightening and deepening the upper part of the river. The estimated cost was $50,000.

In 1868 the project was amended so as to give a wider channel, and the estimate was increased to $80,000. In 1871 the project was extended, the additional cost being estimated at $13,000, making the estimate for the entire project $93,000. It was again extended in 1872, to include the removal of ledges in Lovejoy Narrows, at an additional estimated cost of $30,603.61. This project was modified in 1873, and as modified was completed in 1877.

In 1881 a project was adopted for the improvement of the channel west of Swan Island, and near the north end of it. The estimated cost of this project, which was completed in 1883, was $20,500.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project submitted for the further improvement of the river, giving 12 feet clear depth at low tide up to the Upper Sands Bar, near South Gardiner, 10 feet from thence to Hinckley Shoal, and 8 feet from thence to Augusta, together with an improvement of the steamboat channel west of Swan Island to 9 feet at mean low tide. The estimated cost of this project was $410,500, which estimate was subsequently increased to $428,500.

In August, 1892, the project was revised, and a general project for the improvement adopted, as follows: For a channel depth of 13 feet up as far as Sands Island; 12 feet from thence to Hinckley Shoal, and 10 feet from thence to Augusta; a steamboat channel, 9 feet deep, west of Swan Island, and the removal of old bridge piers at Hallowell, all the above depths being referred to mean low tide. The estimated cost of the revised project is $388,500.

The total expenditures for the river up to June 30, 1892, were $288,792.82.

By the expenditure of this sum the channel near Beef Rock has been improved to give a clear depth of over 12 feet, the dangerous rocks in Lovejoy Narrows have been removed to a depth of 12 feet, and the channel through the Narrows straightened, the shoal near South Gardiner was deepened from 8 feet to 10 feet, the ledge at Nehumkeg was removed to 12 feet, the steamboat channel west of Swan Island has been deepened to 9 feet, and near the head of it to 10 feet, the channel between Gardiner and Augusta has been deepened to 7 feet between Gardiner and Hallowell, and to 6½ feet between Hallowell and Augusta, and the old piers of the bridge at Hallowell have been removed.

Some shoaling has since taken place between Gardiner and Augusta, and some on the bar below South Gardiner, but on the whole a decided betterment of navigation has been accomplished.

The expenditures for the year ending June 30, 1893, have been $21,415.57. A jetty, about 1,500 feet long, was built at Upper Sands Bar, and some work was also done on Beef Rock Jetty, in both cases by purchase of material in open market.

Contracts were made for dredging at and near Gardiner, and for removal of ledge in Lovejoy Narrows. In both cases work was commenced during the early part of June, and was in progress at the close of the year, but not sufficiently advanced to afford material advantage to navigation.

July 1, 1892, balance unexpended		$6,557.18
Amount appropriated by act approved July 13, 1892		100,000.00
		106,557.18
June 30, 1893, amount expended during fiscal year		21,415.57
July 1, 1893, balance unexpended		85,141.61
July 1, 1893, outstanding liabilities	$2,509.50	
July 1, 1893, amount covered by uncompleted contracts	66,118.42	
		68,627.92
July 1, 1893, balance available		16,513.69
Amount (estimated) required for completion of existing project		163,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 11.)

12. Harraseeket River, Maine.—The act approved March 3, 1881, provided that a survey be made of this river. The survey was made in July of that year, and a report submitted in December by the engineer of the district.

The river empties into Casco Bay at Stocksbridges Point, about 12 miles northeast of Portland. From Stocksbridges Point up to Westons Point the depth of water is no less than 10 feet at mean low tide, with no obstruction to navigation.

From Westons Point up to Freeport Landing, a distance of 4,500 feet, the depth diminishes so that for the greater part of the distance the bottom of the river is 3½ feet out of water at mean low tide. The rise and fall of tides here is 9 feet. The project recommended in 1881 was the dredging of a channel not less than 60 feet wide and 3 feet deep at mean low tide up to Freeport, and a turning basin 180 feet wide at the head of the channel. The estimated cost of the improvement recommended was $13,000.

No appropriation was made for the work, however, and a new survey was ordered in the river and harbor act of 1888. A project for the improvement was submitted January 4, 1889. This project was on a somewhat larger scale than the one previously suggested, and contemplated a depth of channel of 5 feet at mean low tide, which would give about 14 feet at high tide. The estimated cost of the project was $36,000.

There had been no expenditures up to the close of the fiscal year ending June 30, 1892, and no work had been done, as it was not deemed expedient to expend any money on the improvement until sufficient funds had been appropriated to accomplish more work than could be done with the amount at that time available.

The expenditures during the year ending June 30, 1893, were $47.80. No work was done.

Proposals for dredging were twice invited by public advertisements, but the prices were regarded as high, and all the bids were rejected. The work will be readvertised at an early date.

July 1, 1892, balance unexpended	$10,000.00
Amount appropriated by act approved July 13, 1892	16,000.00
	26,000.00
June 30, 1893, amount expended during fiscal year	47.80
July 1, 1893, balance unexpended	25,952.20

(See Appendix A 12.)

13. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland or the anchorage has always been good, but prior to the improvements made by the Government the approach to the inner harbor was obstructed by a shoal known as the middle ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford Ledge the greatest available depth was only 16 feet. Besides, the best part of the wharf front of the city was exposed to the swell from the Atlantic, which sometimes made it dangerous for vessels to lie at the docks, and the depth along this front was in some places as little as 4 feet, making a part of it unavailable for commercial purposes.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The project for the improvement of the harbor by deepening its waters was first undertaken by authority of act of Congress of 1868. The project was at that time to excavate a channel 300 feet wide through the southern slope of the middle ground to a depth of 20 feet at mean low tide.

In 1870 the project was amended so as to provide for a channel 400 feet wide, and in 1871 it was again amended so as to provide for a width of 500 feet.

In 1872 the improvement of Back Cove was added to the project, and in December of that year the project was further amended by providing for the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet. By 1876 all the contemplated improvements had been executed except some dredging in the inner harbor.

In 1881 Congress made an appropriation for the further improvement of the harbor, and a project was adopted looking to the entire removal of the shoal known as the middle ground, at an estimated cost of $160,000. The project was completed in 1885.

In 1886 the board of trade of Portland asked for the further improvement of the harbor to a depth of 29 feet at low tide, and in 1887 this project was adopted, the estimated cost being $135,000. This is the project now in process of execution.

The total amount expended on the harbor up to June 30, 1892, inclusive of all works of improvement, was $509,662.84. These expenditures resulted in giving, by means of the breakwater, partial protection to vessels at the lower wharves, and, by means of dredging, an available depth to navigation of 29 feet at mean low tide—a depth sufficient to accommodate the largest class of ocean steamers.

The expenditures during the year ending June 30, 1893, have been $41,673.59. The work accomplished has been the widening of the 29-foot entrance to the harbor, and the dredging of a shoal in the upper harbor to 16 feet at mean low tide. The project is now completed, giving a channel 500 feet wide and 29 feet deep at mean low tide, from the deep water of the anchorage to the lower wharves, with a large area, of the same depth, in front of the wharves.

July 1, 1892, balance unexpended	$36,814.21
Amount appropriated by act approved July 13, 1892	30,000.00
	66,814.21
June 30, 1893, amount expended during fiscal year	41,673.59
July 1, 1893, balance unexpended	25,140.62
July 1, 1893, outstanding liabilities	140.62
July 1, 1893, balance available	25,000.00

(See Appendix A 13.)

14. Channel in Back Cove, Portland, Maine.—Before any work was done toward improving Back Cove there existed no channel properly considered as such. Only the rudiments of an old channel existed, and, for the most part, even this was nearly dry at low tide.

The first project adopted had for its object the dredging of a channel 100 feet wide and 8 feet deep at mean low tide from Tukeys Bridge to the "stone shed wharves." The estimated cost was $10,000. The project was completed in 1874.

A survey was made in 1886, and a new project adopted having in view the widening of the channel to 300 feet and deepening it to 12 feet at mean low tide, with a turning basin at the upper end. The estimated cost was $180,000. This project is now in process of execution.

The expenditures, under the existing project, to the close of the fiscal year ending June 30, 1892, amounted to $51,691.61. At that date the channel had been extended for a distance of 4,050 feet, 12 feet deep at low tide, and 90 feet wide, and a turning basin 400 feet wide excavated.

The expenditures during the fiscal year ending June 30, 1893, were $24,638.60. This amount was applied to widening the channel, under contract. The 12-foot channel is now 160 feet wide for a length of about 1,400 feet, 265 feet wide for a distance of about 1,400 feet more, and 90 feet wide the remaining length.

Proposals for dredging, involving the expenditure of the appropriation of July 13, 1892, were twice invited, but each time the prices were high, and the bids were all rejected.

July 1, 1892, balance unexpended	$24,558.39
Amount appropriated by act approved July 13, 1892	20,000.00
	44,558.39
June 30, 1893, amount expended during fiscal year	24,638.60
July 1, 1893, balance unexpended	19,919.79
Amount (estimated) required for completion of existing project	83,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 14.)

15. Saco River, Maine.—The first work done on the Saco River was in 1827, when an appropriation was made for the erection of piers, placing beacons or buoys, and removing obstructions. Prior to this the depth of water on the bar was only about 2 feet at mean low tide, while much of the river was deeper. The entrance was also dangerous in rough weather, and the numerous projecting rocks and ledges in the river proper, in connection with the swift currents, made its navigation dangerous.

In 1866 a plan was proposed for the improvement of the mouth of the river, and a project adopted in 1867. The project was for the construction of a breakwater at the mouth of the river, the removal of sunken rocks, and the rebuilding of some of the most important piers, against which vessels might drift without damage. The project was completed in 1873 at a cost of $169,275.

Nothing more was done on the Saco until 1883, when a resurvey of the breakwater was made and a new project submitted for raising and repairing it and extending it out to Sharps Ledge.

The river and harbor act of 1884 directed a survey to be made of the river. This was done in 1885, and a project submitted for the improvement of the river proper from its mouth to the head of navigation. In 1886 and 1888 appropriations were made for repairing and raising the breakwater and for improving the river. In 1890 the two projects were combined, so that the one now in process of execution is for improving the Saco River, including the breakwater and the construction of a proposed jetty opposite the same.

The total expenditures on both river and breakwater up to June 30, 1892, were $256,937.22, and resulted in removing the dangerous ledges, in constructing piers to prevent vessels from being swept on the rocks, in constructing a substantial breakwater on the north side of the entrance, and the partial construction of a jetty on the south side of the entrance to contract the channelway with a view to obtaining a greater depth over the bar.

The expenditures during the fiscal year ending June 30, 1893, were $34,760.07, which have been applied to extending the jetty on the south side of the entrance and to the construction of two small jetties at Cow Island. About 3,250 feet of the jetty at the entrance has been built, and an extension of about 1,000 feet farther is nearly finished. At the close of the year about two-thirds of the work of building the two small jetties at Cow Island had been accomplished.

The construction of the jetty on the south side of the entrance has given an increased depth between it and the breakwater, and the construction of the extension is with a view to securing the full projected depth through the bar.

The improvements already made have been of material aid to commerce, but it is impracticable as yet to state the effect of the contraction works, comprising the operations during the past year.

July 1, 1892, balance unexpended		$39,837.78
Amount appropriated by act approved July 13, 1892		25,000.00
		64,837.78
June 30, 1893, amount expended during fiscal year		34,760.07
July 1, 1893, balance unexpended		30,077.71
July 1, 1893, outstanding liabilities	$1,898.23	
July 1, 1893, amount covered by uncompleted contracts	7,942.77	
		9,841.00
July 1, 1893, balance available		20,236.71
Amount (estimated) required for completion of existing project		72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00

Submitted in compliance with requirements of sections 2 river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A 15.)

16. Kennebunk River, Maine.—The first appropriation for the improvement of the Kennebunk River was made in 1829, and was for repairing the piers at the entrance to the river, which were designed to improve the course and depth of the channel. Subsequent appropriations were made for the repair and extension of the piers and a wharf that had been built near the mouth of the river, at which vessels could tie up when the tides and storms detained them.

In 1876 a project was adopted the object of which was to secure a channel 4 feet deep at low tide (the rise and fall of tide being about 9 feet) up to Kennebunkport, a distance of about 1½ miles. The project was completed in 1882.

In 1888 a survey was ordered in the river and harbor act of that year. This was made in 1889, and a project submitted for the repair of the piers and wharf, the latter of which had fallen into decay, and the deepening of the river at Wading Place by the construction of a jetty.

The expenditures to June 30, 1892, were $79,911.71. These expenditures have accomplished the construction of two piers or jetties at the mouth of the river and kept them in repair for many years, the construction and repair of the wharf, the construction of a jetty or dike at Wading Place, and some dredging which was done years ago.

The expenditures during the year ending June 30, 1893, have been $3,672.30. These were applied to completing the permanent repairs to the wharf, and to repairing or strengthening the jetty on the north side of the mouth of the river. The work was finished during the season of 1892, completing the project.

July 1, 1892, balance unexpended	$5,179.80
June 30, 1893, amount expended during fiscal year	3,672.30
July 1, 1893, balance unexpended	1,507.50

(See Appendix A 16.)

17. York Harbor, Maine.—A survey of York Harbor was made in August, 1884, in compliance with the requirements of the river and harbor act of July 5, 1884, and a project suggested having for its object the widening of the channel in three bends where the width did not exceed 75 feet and where the tidal currents are very strong. At the points referred to the channel was to be widened by dredging to 10 feet at mean low tide, that being about the ruling depth in the river. The estimated cost of the improvement was $25,000. It was found that the prices on which the estimate was based were too low, so that in 1887 the estimate was increased to $30,000.

In 1888 the estimate was again revised, as it was found that some of the material to be removed, which was supposed to be gravel and bowlders, proved to be solid ledge. The estimate that year was given as $44,000.

The total expenditures up to June 30, 1892, were $35,000. These expenditures resulted in widening and straightening the channel at the bends, giving much better facilities to navigation and rendering it more safe. Before the improvements were begun the channel was very crooked and difficult to navigate on account of the swift currents.

The expenditures during the fiscal year ending June 30, 1893, were $23.94. A contract was made in December, 1892, for dredging at the entrance and in the harbor basin, the work to be done during the present season, which will complete the project.

Amount appropriated by act approved July 13, 1892		$9,000.00
June 30, 1893, amount expended during fiscal year		23.94
July 1, 1893, balance unexpended		8,976.06
July 1, 1893, outstanding liabilities	$50.00	
July 1, 1893, amount covered by uncompleted contracts	8,100.00	
		8,150.00
July 1, 1893, balance available		826.06

(See Appendix A 17.)

18. Bellamy River, New Hampshire.—A survey was made of the Bellamy River in 1887, and a project of improvement suggested, at an estimated cost of $28,000.

The project is to secure a channel 50 feet wide and 5 feet deep, at mean low tide, from the mouth of the river up to Sawyer's Mill, at Dover. The rise and fall of the tide being about 7 feet, a high-water navigation of 12 feet will be secured.

The above project was adopted in 1888, and its execution is now in progress.

The expenditures up to the close of the fiscal year ending June 30, 1892, have been $10,120.34. These expenditures have resulted in giving a channel from the mouth of the river up to about 1 mile above Robert's brickyard, 50 feet wide and 5 feet deep at low tide. In other words, about 1 mile was added to the navigable part of the river.

The expenditures during the fiscal year ending June 30, 1893, were $9,561.27. The operations during the year consisted in dredging 35,997 cubic yards, under contract, thereby adding about three-fourths of a mile to the navigable part of the river.

Proposals were opened in November, 1892, for dredging, involving the expenditure of the appropriation of 1892, but the prices being high, all the bids were rejected. The work will be readvertised.

July 1, 1892, balance unexpended	$9,879.66
Amount appropriated by act approved July 13, 1892	7,500.00
	17,379.66
June 30, 1893, amount expended during fiscal year	9,561.27
July 1, 1893, balance unexpended	7,818.39
Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A 18.)

19. Cocheco River, New Hampshire.—Before the improvement was begun the river from Dover to the Lower Narrows was much obstructed by bowlders, ledges, and shoals, the depth being in some places as little as 6 inches at mean low tide. The tide here rises and falls about 6.75 feet.

The first regular project for improvement was adopted in 1871, and looked to the forming of a channel 40 feet wide and 4 feet deep from the Lower Narrows up to Collin's Wharf. The estimated cost was $45,000. Subsequently more accurate and extended surveys have shown the practicability and importance of extending the improvement up to the head of navigation, and the project was extended and the estimate increased to $85,000.

The project was completed by 1879. The improvements made had opened up a large commerce, employing large vessels where formerly only flatboats had been used, in consequence of which the project was still further extended by providing for a "cut-off" through Alleys Point, widening to 60 feet and deepening to 5 feet the existing channels through Trickeys and Clements shoals, and blasting and removing other obstructions. The extended project was completed in 1888.

In 1889 a new survey was made, in compliance with the requirements of the river and harbor act of August, 1888, and as the large increase of trade seemed to justify still further improvement of the river a new project was submitted, looking to obtaining a depth of 7 feet, increased to 7½ in rock, and a minimum width of 50 feet in rock and 60 to 75 where the material is less expensive to remove. This project was adopted in 1890.

The expenditures up to June 30, 1892, have been $194,404.12. These have resulted in giving a channel through the rocky bed of the river 5 feet deep at low tide, and 40 feet wide in the narrowest parts.

The upper end of the channel in front of the wharves at Dover has been deepened to 7 feet at mean low tide, for a length of 1,200 feet, with widths varying from 100 to 140 feet. Portions of the channel above and below Clement's Wharf, of a total length of 600 feet, have also been dredged to the same depth.

The expenditures during the fiscal year ending June 30, 1893, were $29.88. No work was done. Proposals for dredging, under the appropriation of July 13, 1892, were twice opened, but were each time rejected, the prices being regarded as high.

The improvements in the navigation of the Cocheco have been of great benefit to the people of Dover and the vicinity. In the item of coal alone it is reported that not less than 35,000 tons are supplied

annually at a saving of 50 cents per ton, which could not have been done had no improvements been made.

July 1, 1892, balance unexpended		$595.88
Amount appropriated by act approved July 13, 1892		15,000.00
		15,595.88
June 30, 1893, amount expended during fiscal year		29.88
July 1, 1893, balance unexpended		15,566.00
July 1, 1893, outstanding liabilities		25.00
July 1, 1893, balance available		15,541.00
Amount (estimated) required for completion of existing project		135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix A 19.)

20. Harbor of refuge at Little Harbor, New Hampshire.—A survey was made of Little Harbor in 1882, and a plan of improvement proposed, which looked to the opening of a channel of entrance to a depth of 9 feet at low tide, and a width of 100 feet, together with a basin 300 feet by 700 feet, which was to be protected by a rubble-stone breakwater. The estimated cost was $33,000. This project was approved in 1886, and its execution entered upon. In 1887 the project was enlarged, as the old one did not seem to meet the requirements of those interested. The enlarged project provided for the construction of two breakwaters, one on the north, the other on the south side of the entrance to the harbor, and the dredging of an anchorage about 49 acres in extent, in the protected area, to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was $235,000. The project was adopted by Congress in 1888.

Before the improvement was begun the harbor was exposed to the full force of the sea in northeast gales, and the depth of water at the entrance and within the harbor was not sufficient to accommodate even small craft at low tide.

The total expenditures up to June 30, 1892, have been $42,422.83. These expenditures have been applied to dredging part of the area for an anchorage, and to the partial construction of the breakwater on the south side of the harbor.

The expenditures during the fiscal year ending June 30, 1893, were $3,068.03.

The operations consisted in work on the partially completed breakwater at south side of the entrance to the harbor, and in dredging the anchorage. The breakwater is not yet finished, though it affords some protection. The dredging of the anchorage was commenced during the latter part of May, 1893, and by the close of the year about 47,500 cubic yards had been dredged.

July 1, 1892, balance unexpended		$27,577.17
Amount appropriated by act approved July 13, 1892		30,000.00
		57,577.17
June 30, 1893, amount expended during fiscal year		3,068.03
July 1, 1893, balance unexpended		54,509.14
July 1, 1893, outstanding liabilities	$662.67	
July 1, 1893, amount covered by uncompleted contracts	52,963.29	
		53,625.96
July 1, 1893, balance available		883.18

Amount (estimated) required for completion of existing project.....$135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix A 20.)

21. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the wreck of the schooner *Isabel Alberto*, in Rockland Harbor, Maine, and the masts of the schooner *Huntress*, sunk off Browneys Island, Maine, were removed under the provisions of the act of June 14, 1880, at a cost of $972.39. (See Appendix A 21.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. Peter C. Hains, Corps of Engineers, and reports thereon submitted.

1. Channel near Hardys Point, below Pembroke, Me.—Lieut. Col. Hains submitted report of examination under date of October 1, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 104, Fifty-second Congress, second session. (See also Appendix A 22.)

2. South Fork of Bagaduce River, Maine.—Lieut. Col. Hains submitted report of examination under date of August 17, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 17, Fifty-second Congress, second session. (See also Appendix A 23.)

3. Vinal Haven or Carver Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of October 26, 1892. It is his opinion, concurred in by this office, that the locality is worthy of improvement by the General Government to a limited extent. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $800. The report was transmitted to Congress and printed as House Ex. Doc. No. 31, Fifty-second Congress, second session. (See also Appendix A 24.)

4. Lincolnville (Duck Trap) Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of October 17, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 100, Fifty-second Congress, second session. (See also Appendix A 25.)

5. Frenchs Beach Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of October 17, 1892. It is his opinion, concurred in by this office, that the harbor is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 25, Fifty-second Congress, second session. (See also Appendix A 26.)

6. Rockland Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of August 17, 1892. It is his opinion, concurred in by this office, that this harbor is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $1,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 105, Fifty-second Congress, second session. (See also Appendix A 27.)

7. Owls Head Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of October 18, 1892. It is his opinion, concurred in by this office, that the harbor is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 67, Fifty-second Congress, second session. (See also Appendix A 28.)

8. Tennant Harbor, Maine.—Lieut. Col. Hains submitted report of examination under date of October 18, 1892. It is his opinion, concurred in by this office, that the harbor is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 101, Fifty-second Congress, second session. (See also Appendix A 29.)

9. Georges River, Maine.—Lieut. Col. Hains submitted report of examination under date of October 17, 1892. It is his opinion, concurred in by this office, that the river up as far as Thomaston is worthy of improvement by the General Government. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $1,200. The report was transmitted to Congress and printed as House Ex. Doc. No. 58, Fifty-second Congress, second session. (See also Appendix A 30.)

10. Portland Harbor, Maine, with a view to extending the channel along the front of the wharves on the south side of the harbor, so as to give a depth of 8 feet at mean low water as far south as the Plush Mill Wharf.—Lieut. Col. Hains submitted report of examination under date of November 19, 1892. It is his opinion, concurred in by this office, that Portland Harbor is not worthy of improvement by the General Government in the manner proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 102, Fifty-second Congress, second session. (See also Appendix A 31.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS.

This district was in the charge of Lieut. Col. S. M. Mansfield, Corps of Engineers.

1. Newburyport Harbor, Massachusetts.—The object of the improvement is to create a channel through the outer bar, 1,000 feet wide and with a least depth of 17 feet at mean low water, or 24½ feet at mean high water.

The project, adopted in 1880 and modified in 1883, is to build two converging rubblestone jetties, so located as to give a proper direction to the current, and thereby produce and maintain the desired result. The estimated cost of the project was $375,000.

The original depth of water on the bar was 7 feet at mean low water.

To June 30, 1892, $251,023.79 had been expended, and the north jetty was 2,675 feet long, of which 2,485 had been completed. The south jetty was 1,300 feet long, of which 1,077 feet were completed.

The Plum Island Dike was 817 feet long, 5½ feet high above mean low water except near the center, where a weir 150 feet long and 2 feet above mean low water was left temporarily.

The sand catch in rear of the south jetty was in two branches, one 480 feet long and one 572 feet long.

All these works were in good order. On September 16, 1892, a contract was entered into, to deposit 15,000 tons of rubblestone in the north jetty. Operations under this contract were commenced in May, 1893, and during the fiscal year 669 tons of stone had been placed in the north jetty, essentially completing 25 feet of its length. During

the latter part of June, 1893, a survey of the bar was made. It showed that the channel across the bar had straightened, widened, and deepened since the survey of 1891, it being not less than 13.6 feet deep.

The condition of the Plum Island Dike, the south jetty, and the catch sand remain unchanged since June 30, 1892.

The advantages to be derived from the completion of the project are increased safety and facility of navigation.

July 1, 1892, balance unexpended		$6,476.21
Amount appropriated by act approved July 13, 1892		20,000.00
		26,476.21
June 30, 1893, amount expended during fiscal year		818.08
July 1, 1893, balance unexpended		25,658.13
July 1, 1893, outstanding liabilities	$1,112.04	
July 1, 1893, amount covered by uncompleted contracts	22,786.29	
		23,898.33
July 1, 1893, balance available		1,759.80

Amount (estimated) required for completion of existing project	97,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	97,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 1.)

2. Merrimac River, Massachusetts.—The object of the improvement is to straighten, deepen, and widen the natural channel of the river from its mouth to the Upper Falls, a distance of 21½ miles.

The channel originally was narrow, crooked, and much obstructed by ledges, bowlders, and shoals; and below Newburyport by ledges, cribs, piers, and wrecks.

At mean low water vessels drawing not to exceed 7 feet could cross the bar and proceed about 6 miles above Newburyport.

The mean rise or fall of the tide at the mouth of the river is 7½ feet; at Haverhill bridge, 4 feet.

The project, originally adopted in 1870, proposed to remove obstructions from the Upper and Lower Falls, to remove Gangway Rock, to remove the wreck of the "Globe," and to remove the "boilers."

The cost was estimated at $69,025.

This project was revised and extended in 1874 to include the removal of rocks at Deer Island and Rock bridges, and at Little Curriers Shoal, so that the channel should have the following depths at ordinary high-water stages of the river: From the mouth to Deer Island Bridge (5 miles), 16½ feet; thence to Haverhill Bridge (12½ miles), 12 feet; thence to the foot of Mitchells Falls (1½ miles), 10 feet; through Mitchells Falls to the head of the Upper Falls (2½ miles), not less than 4½ feet, with the mill water at Lawrence running. This revised project was estimated to cost $147,000.

The total appropriations to date have been $242,366.72.

The expenditures to June 30, 1892, were $230,876.20, and the river channel had been improved in accordance with the modified project, with the exception of the removal of the "boilers" at Newburyport.

During the fiscal year a contract was entered into for the removal of the "boilers." Operations were commenced under this contract in October, 1892, and 201 cubic yards of ledge was removed up to the close of the fiscal year.

The act of July 13, 1892, provided "That the amount appropriated in act of September 19, 1890, for improving Merrimac River at Mitchells

Falls may be applied to the general improvement of the river in the discretion of the Secretary of War," and under this provision the amount is being expended in the removal of the "boilers."

The improved channel is in good order.

July 1, 1892, balance unexpended		$9,990.52
Amount appropriated by act approved July 13, 1892		1,500.00
		11,490.52
June 30, 1893, amount expended during fiscal year		2,399.00
July 1, 1893, balance unexpended		9,091.52
July 1, 1893, outstanding liabilities	$1,484.72	
July 1, 1893, amount covered by uncompleted contracts	2,091.35	
		3,576.07
July 1, 1893, balance available		5,515.45

(*See* Appendix B 2.)

3. Powow River, Massachusetts.—Powow River is a tributary of the Merrimac River, into which it enters from the north, about 3½ miles above Newburyport.

From its mouth tide water extends 9,600 feet in a narrow, crooked channel, not navigable at low water.

The project proposed for its improvement is to dredge a channel 9,000 feet long, 60 feet wide, and 12 feet deep at mean high water, at an estimated cost of $77,000.

The river and harbor acts of 1888 and 1890 appropriated $8,000 for this work, provided a suitable draw was built in the bridge which crossed the mouth of the river. The act of July 13, 1892, appropriated a further sum of $4,000 for improving this river.

The condition required by the proviso in the acts making appropriations for this improvement has been complied with, but the funds available are inadequate to obtain any appreciable benefit to commerce, and they will be retained in the Treasury until additional funds are provided.

No expenditures were made during the year ending June 30, 1893, and the original condition of the river is unaltered.

July 1, 1892, balance unexpended	$8,000.00
Amount appropriated by act approved July 13, 1892	4,000.00
	12,000.00
July 1, 1893, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project	65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1888 and 1892 and of sundry civil act of March 3, 1893.	

(See Appendix B 3.)

4. Ipswich River, Massachusetts. Ipswich River empties into Plum Island Sound, about 9 miles south of Newburyport, Mass. It is navigable from its mouth to the wharves at Ipswich, a distance of 3 miles. Before improvement, at low water, not to exceed 1½ feet draft could be carried in a narrow channel.

The mean rise or fall of the tide is 8.4 feet.

The object of the improvement is to widen and deepen the natural channel of the river.

The original project was submitted in 1875. It proposed a channel 60 feet wide and 4 feet deep at mean low water.

In 1887 the project was modified by limiting the present improvement to opening a channel 60 feet wide and 4 feet deep through "The Shoals" and "Labor in Vain," and extending it to the "Deep Hole" opposite the town wharves.

The amount appropriated for this improvement to date is $7,500.

The amount expended to June 30, 1892, was $2,537.08.

On September 17, 1892, a contract was entered into to complete the partial project. No work was done under this contract during the fiscal year.

The condition of the improvement June 30, 1893, is the same as on June 30, 1892.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1892, balance unexpended	$2,462.92
Amount appropriated by act approved July 13, 1892	2,500.00
	4,962.92
June 30, 1893, amount expended during fiscal year	19.21
July 1, 1893, balance unexpended	4,943.71
July 1, 1893, amount covered by uncompleted contracts	2,100.00
July 1, 1893, balance available	2,843.71

(See Appendix B 4.)

5. Essex River, Massachusetts.—Essex River empties into Ipswich Bay about 3 miles southeast of the mouth of Ipswich River, Massachusetts. It is navigable at high water to the wharves in the town of Essex, a distance of 6 miles, but no navigable low-water channel exists for 12,000 feet below the town wharves.

The mean rise or fall of the tide is 8.8 feet.

The object of the improvement is to widen and deepen the natural channel of the river.

The project for improvement was submitted May 15, 1891, and proposed a channel 60 feet wide, 4 feet deep at mean low water to the wharves at Essex, estimated to cost $25,000.

The total appropriations to date have been $5,000.

No work has been done under the project and the original condition of the river remains unchanged.

The prospective benefits to commerce are increased facilities and safety to navigation.

Amount appropriated by act approved July 13, 1892	$5,000.00
July 1, 1893, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 5.)

6. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.—This bay is situated at the northeastern extremity of Cape Ann, Massachusetts. It is open to the full effects of easterly and northeasterly gales.

The proposed improvement contemplates the construction of a national harbor of refuge of the first class. The anchorage covered by the breakwater will contain 1,377 acres.

The estimated cost of the improvement is $5,000,000. The original project of 1884 proposed to build only the substructure of the breakwater of rubblestone. The present project, approved March 17, 1892, proposes to build the entire breakwater of rubblestone.

The total appropriations to date are $600,000. The expenditures, not including outstanding liabilities, to June 30, 1892, were $399,341.89.

The condition of the improvement on June 30, 1892, was as follows: 515,688 tons of rubblestone had been deposited in the breakwater, essentially completing the substructure to a grade 22 feet below mean low water, between cross ranges 140 and 4740. Twenty-two thousand two hundred and forty-six tons of rubblestone was afterwards deposited to complete a contract existing at that date.

On September 30, 1892, a contract was entered into for the deposit of 14,000 tons of large stone and 120,000 tons of small stone in the breakwater. Operations under this contract were commenced in October, 1892, and at the close of the fiscal year 53,139 tons of small stone and 724 tons of large stone had been deposited, approximately completing 50 feet of the breakwater.

The prospective benefits to commerce and navigation by the completion of this harbor of refuge are increased safety to life and property, and a consequent reduction in freights and insurance.

July 1, 1892, balance unexpended		$50,658.11
Amount appropriated by act approved July 13, 1892		150,000.00
		200,658.11
June 30, 1893, amount expended during fiscal year		77,143.19
July 1, 1893, balance unexpended		123,514.92
July 1, 1893, outstanding liabilities	$13,562.82	
July 1, 1893, amount covered by uncompleted contracts	90,439.37	
		104,002.19
July 1, 1893, balance available		19,512.73

Amount (estimated) required for completion of existing project	4,400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 6.)

7. Gloucester Harbor, Massachusetts.—Gloucester Harbor is an important center for the fishing fleet of New England, about 20 miles north of Boston. Its inner harbor was originally obstructed by sunken rocks and shoals, and the approaches to the wharves were shallow, varying from 1 to 12 feet. The outer harbor was open to all southerly winds.

The first project for its improvement was submitted January 20, 1871, and proposed to build a breakwater from Eastern Point to Round Rock Shoal, and to clear the harbor of sunken rocks.

The present approved project was submitted in 1887. It proposed to remove from the inner harbor obstructing rocks and shoals, giving in front of the wharves, so far as Pew's Wharf, 15 feet depth at low water, and 10 feet in Harbor Cove, and to build a breakwater from Eastern Point to Round Rock Shoal, in substantially the same location as that proposed in the project of 1871.

The total appropriations to date have been $80,000.

The expenditures to June 30, 1892, were $36,692.37, and at that date the condition of the improvement was as follows: Clam Rock, Pinnacle Rock, rock off J. Friend's Wharf, and rock off Pew's Wharf had been reduced to the level of the surrounding bottom, and Babson's Ledge to 14 feet at mean low water. Two channels of approach to the wharves in Harbor Cove had been dredged; each was 140 feet wide and 10 feet deep at mean low water; the eastern one was 550 feet long, the western 1,000 feet long. In the inner harbor 15 feet depth had been obtained in front of

the wharves so far as the steamboat wharf, except over four small ledges uncovered by the dredging near the Halibut Company's Wharf. Nothing had been done on the breakwater.

On September 16, 1892, a contract was entered into for the completion of the proposed dredging. No operations have been in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

July 1, 1892, balance unexpended	$3,307.63
Amount appropriated by act approved July 13, 1892	40,000.00
	43,307.63
June 30, 1893, amount expended during fiscal year	29.13
July 1, 1893, balance unexpended	43,278.50
July 1, 1893, amount covered by uncompleted contracts	34,500.00
July 1, 1893, balance available	8,778.50
Amount (estimated) required for completion of existing project	752,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 7.)

8. Manchester Harbor, Massachusetts.—Manchester Harbor is situated about 5½ miles northeast from the entrance of Salem Harbor, Massachusetts.

The channel was 100 feet wide and 6½ feet deep at mean low water up to Proctor's Point; it then shoaled rapidly to a depth of 1½ feet at the "Narrows," 1,400 feet from Proctor's Point, and for a further distance of 2,500 feet to the town wharves no low-water channel existed.

The project for its improvement proposed to dredge a channel from Proctor's Point to the town wharves, 60 feet wide and 4 feet deep at mean low water, at an estimated cost of $14,300. The total appropriations to date have been $14,300. The expenditures to June 30, 1892, were $7,122.09. On June 30, 1892, the improved channel was 35 feet wide 4 feet deep at mean low water from Proctor's Point to the railroad bridge, a distance of 2,900 feet.

On September 17, 1892, a contract was entered into for the completion of the project. No operations were in progress under this contract during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

July 1, 1892, balance unexpended	$377.91
Amount appropriated by act approved July 13, 1892	6,800.00
	7,177.91
June 30, 1393, amount expended during fiscal year	33.84
July 1, 1893, balance unexpended	7,144.07
July 1, 1893, amount covered by uncompleted contracts	5,999.94
July 1, 1893, balance available	1,144.13

(See Appendix B 8.)

9. Salem Harbor, Massachusetts.—Salem Harbor is 12 miles northward of Boston, Mass. It contains a well-sheltered, entirely unobstructed anchorage of about 110 acres, more than 18 feet deep at mean low water.

The principal city wharves are located on South River, a small stream entering the harbor. This river was 3,000 feet long, from 150 to 300 feet wide, and not navigable at low tide.

The original project for the improvement of this harbor was submitted December 16, 1872. It proposed to dredge a channel of approach to the mouth of South River, 1,730 feet long, 300 feet wide, and 8 feet deep at mean low water. This project was essentially completed in 1873–'75.

The present project was submitted December 2, 1889. It proposed to clear out the channel as originally dredged, and to extend it to the head of navigation, gradually reducing its width from 150 feet at the mouth of the river to 100 feet near the inner end of Derby Wharf, and above this to excavate a channel 50 feet wide. To the inner end of Derby Wharf the improved channel to be 8 feet deep at mean low water, and above this point 6 feet deep. The total length of the improved channel to be 5,100 feet approximately.

The total appropriations to date have been $53,000. The expenditures to June 30, 1892, were $37,782.62. At that date the entrance channel dredged in 1873–'75 had been cleared out to essentially its original dimensions, and the improved channel was 50 feet wide, 8 feet deep to near the inner end of Derby Wharf, and thence, to the head of navigation, 6 feet deep, at mean low water.

On September 17, 1892, a contract was entered into to complete the proposed improvement. No operations were in progress under this contract during the fiscal year.

July 1, 1892, balance unexpended	$1,217.38
Amount appropriated by act approved July 13, 1892	14,000.00
	15,217.38
June 30, 1893, amount expended during fiscal year	18.58
July 1, 1893, balance unexpended	15,198.80
July 1, 1893, amount covered by uncompleted contracts	8,000.00
July 1, 1893, balance available	7,198.80

(See Appendix B 9.)

10. Lynn Harbor, Massachusetts.—Lynn Harbor is 9 miles northeast from Boston.

The original channels were narrow and crooked, and had but 6 feet depth at mean low water.

The project for improvement was adopted in 1884. It proposed a channel 200 feet wide, 10 feet deep at mean low water, through the outer and inner bars. It is supposed that the inner channel will require occasional dredging, and a training wall was proposed, if required, to aid in keeping the outer channel open.

On September 24, 1888, it was proposed to extend the inner channel 400 feet within the harbor line, and to excavate at its inner end an anchorage basin 500 by 300 feet in area, 10 feet deep at mean low water, at a cost of $25,000.

The estimated cost of the original project was $157,000.

The total appropriations to date have been $101,000.

The amount expended to June 30, 1892, was $85,098.13. At that date the outer channel and basin were completed as proposed, and the inner channel was 150 feet wide.

On January 5, 1893, a contract was entered into to dredge a channel 150 feet wide, 8 feet deep at mean low water, at the entrance of the western channel, and to widen the inner channel of the main harbor to 200 feet, so far as the balance available would permit. Operations were commenced in June, 1893, in the western channel under this contract, and 4,583 cubic yards was dredged during the fiscal year.

July 1, 1892, balance unexpended		$5,901.87
Amount appropriated by act approved July 13, 1892		10,000.00
		15,901.87
June 30, 1893, amount expended during fiscal year		654.28
July 1, 1893, balance unexpended		15,247.59
July 1, 1893, outstanding liabilities	$1,552.49	
July 1, 1893, amount covered by uncompleted contracts	11,997.51	
		13,550.00
July 1, 1893, balance available		1,697.59

Amount (estimated) required for completion of existing project	81,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of the sundry civil act of March 3, 1893.	

(See Appendix B 10.)

11. Winthrop Harbor, Massachusetts.—Winthrop Harbor is situated in the northeastern part of Boston Harbor. It contains 350 acres, approximately, all of which is essentially dry at low tide. The mean range of tides is 9.4 feet.

The original project for its improvement proposed to dredge a straight channel 3,900 feet long, 50 feet wide, 6 feet deep at mean low water, from the "Back" channel of Boston Harbor to Rice's Wharf.

The total appropriations to date have been $9,000.

The expenditures to June 30, 1892, were $5,497.80. At that date the improved channel was 3 feet deep at mean low water, 3,900 feet long, and 35 feet wide.

On December 20, 1892, a contract was entered into for the completion of the proposed improvement. Operations under this contract were commenced in March and completed in May, 1893.

At the date of this report the improved channel is 3,900 feet long, 50 feet wide, 6 feet deep at mean low water.

July 1, 1892, balance unexpended	$502.20
Amount appropriated by act approved July 13, 1892	3,000.00
	3,502.20
June 30, 1893, amount expended during fiscal year	3,477.05
July 1, 1893, balance unexpended	25.15

(See Appendix B 11.)

12. Mystic and Malden rivers, Massachusetts.—These two rivers empty into the inner harbor of Boston, Mass.

Malden River is tributary to the Mystic River, their junction being about three miles above the mouth of the latter.

Originally no low-water channel existed in either river.

A project for the improvement of Mystic River was submitted May 9, 1891. It proposed to widen and deepen the natural channel to the head of navigation in Medford, a distance of about 4½ miles, so that it should be 100 feet wide, 6 feet deep at mean low water, to the first turn above Denning's wharf; thence 4 feet deep at mean low water, the width gradually contracting to 50 feet at the upper end; estimated to cost $25,000.

The original project for the improvement of Malden River was submitted December 1, 1880, and was modified in 1882. The modified project proposed to make the natural channel 100 feet wide, 12 feet deep at mean *high* water, to the first bridge, and thence 75 feet wide to

the second bridge, the estimated cost of completing this work being $37,000.

The mean range of tides is 9.8 feet.

Ten thousand dollars was appropriated for the improvement of Malden River in 1882, and expended, 1883–'84, in accordance with the project, making a channel 50 feet wide, 12 feet deep at mean high water, to the first bridge.

The act of July 13, 1892, appropriated $10,000 for the improvement of Mystic and Malden rivers. Five thousand dollars of this amount is retained in the Treasury for the improvement of Malden River (when additional funds are available), and the balance will be expended in improving Mystic River as proposed.

Bids were opened September 8, 1892, for the proposed work in Mystic River, but the lowest was rejected as excessive.

No other operations were in progress during the fiscal year.

At the date of this report the original condition of Mystic River is unchanged; and the improved channel of Malden River is at least 50 feet wide, 12 feet deep at mean high water, to the first bridge in Malden, a distance of 1¼ miles.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	41.55
July 1, 1893, balance unexpended	9,958.45
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 12.)

13. Boston Harbor, Massachusetts.—The object of this improvement is, first, to preserve the harbor by protecting the islands and headlands; and, second, to improve it by widening, straightening, and deepening the channels.

The projects adopted for this purpose since 1866 have been mainly in accordance with the recommendations of the United States commissioners whose labors terminated during that year.

The works of preservation consist of sea-walls, aprons, jetties, etc., which protect the shores of the islands and headlands, prevent additional wash into the channels, control tidal scour, and preserve the full height of anchorage shelter for vessels in the roadsteads. Such have been built or repaired at Point Allerton, and the islands of Great Brewster, Lovells, Gallops, Long Deer, Rainsford, Georges, and Castle.

The works of improvement have been by dredging and blasting, by which means many dangerous rocks and shoals have been removed and the main ship channel enlarged from 100 feet wide and 18 feet deep at mean low water, so that it is now at least 625 feet wide and 23 feet deep at mean low water.

The following tributary channels have also been improved:

a. Charles River.—The natural channel of this river has been widened, straightened, and deepened, so that from its mouth to Western Avenue Bridge, a distance of 4¾ miles, the channel has a width of 200 feet, and a depth of 7 feet at mean low water; thence to Arsenal Street Bridge, 2½ miles, the channel has a least width of 80 feet and a least depth of 6 feet.

b. Fort Point Channel.—This important branch of the main ship channel had a least depth of 12 feet at its entrance, and the channel was narrow and crooked. It has been widened to 175 feet, and deep-

ened to 23 feet at mean low water from its mouth to Congress Street Bridge, a distance of 1,900 feet.

c. Hingham Harbor.—See separate report.

d. Nantasket Beach Channel.—This channel was originally about 50 feet wide, 8 feet deep at mean low water. It is now 150 feet wide, 10 feet deep at mean low water.

e. Channel between Nix's Mate and Long Island.—This channel had originally 4½ feet depth at mean low water. A cut has been made through the bar 300 feet wide, 15 feet deep at mean low water.

f. Broad Sound.—An obstruction called Barrel Rock was removed in 1869.

The total expenditures to June 30, 1892, were $2,216,351.59.

During the fiscal year the main ship channel was widened at the upper middle from 800 feet to 850 feet, and at Jeffreys Point from 275 feet wide to 350 feet wide.

A revised project was adopted August 11, 1892, which proposes to make the main ship channel 27 feet deep and 1,000 feet wide throughout.

A contract was entered into under date of October 17, 1892, for dredging the main ship channel, and 5,666 cubic yards was removed under this contract during the fiscal year.

A contract was entered into under date of September 30, 1892, for dredging in channel off Jeffreys Point, and 20,697 cubic yards was dredged during the fiscal year.

A contract was entered into under date of September 22, 1892, for dredging in Nantasket Beach Channel, and 21,594 cubic yards was dredged during the fiscal year.

All these contracts were in force at the close of the fiscal year.

Repairs were made to the sea wall at Great Brewster Island, and the riprap at the west end of the Long Island sea wall was extended.

At the date of this report the several works of preservation are in fair order; the main ship channel is 23 feet deep at mean low water, 1,100 feet wide west of the upper middle, 850 feet wide at the upper middle, 1,000 feet wide at the lower middle, and at least 625 feet wide at the Narrows. The subsidiary channels are in the same condition as at the date of the last report.

July 1, 1892, balance unexpended		$87,924.51
Amount appropriated by act approved July 13, 1892		300,000.00
		387,924.51
June 30, 1893, amount expended during fiscal year		48,512.21
July 1, 1893, balance unexpended		339,412.30
July 1, 1893, outstanding liabilities	$9,009.30	
July 1, 1893, amount covered by uncompleted contracts	248,540.08	
		257,549.38
July 1, 1893, balance available		81,862.92

Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	700,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 13.)

14. Weymouth River, Massachusetts.—Weymouth (Fore) River empties into the southwestern part of Boston Harbor, Massachusetts. For 4 miles it was navigable at low water for vessels drawing 18 feet, and to the head of navigation, an additional 3 miles, at least 3 feet depth was to be found.

The original project for its improvement was submitted December 2, 1889. It proposed to improve the natural channel so that 6 feet at mean low water could be carried to the head of navigation in a channel 100 feet wide to near Weymouth Landing, thence to Braintree Bridge 80 feet wide, and above the bridge 50 feet wide; the total length of improved channel to be 7,000 feet, and to cost $40,000.

The total appropriations to date have been $20,000.

The expenditures to June 30, 1892, were $10,000. At that date the improved channel was 6 feet deep at mean low water, 40 feet wide to Braintree Bridge, and 25 feet wide thence to the head of navigation.

On September 8, 1892, bids were received for the continuance of work under the approved project, but the lowest bid was rejected as excessive. No other operations were in progress during the fiscal year, and the condition of the improved channel remains unchanged since June 30, 1892.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	38.64
July 1, 1893, balance unexpended	9,961.36
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 14.)

15. Hingham Harbor, Massachusetts.—The object of this improvement is to widen and deepen the natural channel, which was 30 feet wide and 4 feet deep, so that it will be 100 feet wide and 10 feet deep at mean low water.

The project was originally proposed in 1874, and was modified in 1885. The original project was estimated to cost $11,000. The project of 1885 was to cost an additional sum of $18,750.

The total appropriations to date have been $29,000, and the expenditures to June 30, 1892, were $25,088.35.

On June 30, 1892, the improved channel had been completed as proposed, excepting the removal of a mid-channel ledge, near Chandlers Island.

During the fiscal year a contract was entered into for the removal of the mid-channel ledge near Chandlers Island. Operations under this contract were commenced in October, 1892, and were satisfactorily completed in May, 1893.

At the date of this report the project for the improvement of the harbor had been completed, and the improved channel is in good order.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1892, balance unexpended	$911.65
Amount appropriated by act approved July 13, 1892	3,000.00
	3,911.65
June 30, 1893, amount expended during fiscal year	3,897.41
July 1, 1893, balance unexpended	14.24

(See Appendix B 15.)

16. Scituate Harbor, Massachusetts.—This harbor is on the west shore of Massachusetts Bay, about 14 miles south of Boston Light.

The object of the improvement is to create a harbor of refuge for vessels bound to Boston from the eastward which are too far south of

their true course to clear the dangerous ledges near Minots Ledge Light.

Originally the harbor had a low-water area of about 57 acres, more than 6 acres of which had a depth of at least 3 feet at mean low water. It was entirely open to the force of easterly gales, and its entrance was obstructed by sunken bowlders.

The project, adopted in 1880, is to build two breakwaters, one from Cedar Point, on the north side of the entrance, and the other from the First Cliff, on the south side, and to dredge the area inclosed and in front of the entrance. The estimated cost of the improvement is $290,000.

The total amount appropriated to date is $73,680.

The amount expended to June 30, 1892, was $63,530. At that date the north breakwater was essentially completed. Nothing had been done on the south breakwater. The anchorage basin was 350 by 450 feet in area, 7 feet deep at mean low water. The entrance channel was 1,600 feet long, 100 feet wide, 5 feet deep at mean low water. The channel connecting the basin with the town wharves was 2,100 feet long, 100 feet wide, 3 feet deep at mean low water.

On September 17, 1892, a contract was entered into for the deposit of 3,643 tons of rubblestone in the south breakwater. Operations under this contract were commenced in September, 1892, and during the fiscal year 2,745½ tons of rubblestone was placed in the south breakwater.

At the date of this report the south breakwater is essentially completed for 250 feet in length. The north breakwater, anchorage basin, and improved channels remain unchanged since June 30, 1892.

The prospective benefits to commerce by the completion of this improvement are the creation of an additional harbor of refuge on this much-frequented dangerous coast.

July 1, 1892, balance unexpended		$150.00
Amount appropriated by act approved July 13, 1892		10,000.00
		10,150.00
June 30, 1893, amount expended during fiscal year		6,429.84
July 1, 1893, balance unexpended		3,720.16
July 1, 1893, outstanding liabilities	$1,189.43	
July 1, 1893, amount covered by uncompleted contracts	2,206.82	
		3,396.25
July 1, 1893, balance available		323.91

Amount (estimated) required for completion of existing project	217,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 16.)

17. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved

channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $179,766.90.

The expenditures to June 30, 1892, were:

For beach protection	$122,553.77
For dredging	45,719.83
Total	168,273.60

On June 30, 1892, the improved channel was 2,286 feet long, 130 feet wide; the basin was 866 feet long, 150 feet wide; both were 9 feet deep at mean low water. Long Beach was in fair condition, but additional bulkheads were needed at its southern end.

On September 16, 1892, a contract was entered into to widen the improved channel to 150 feet. Operations under this contract were commenced in December, 1892, and were satisfactorily completed in April, 1893. No other operations were in progress during the fiscal year.

At the date of this report the proposed improvement by dredging is completed. Some repairs and extensions of the works protecting Long Beach are necessary.

July 1, 1892, balance unexpended	$2,292.65
Amount appropriated by act approved July 13, 1892	9,500.00
	11,792.65
June 30, 1893, amount expended during fiscal year	5,094.41
July 1, 1893, balance unexpended	6,698.24
Amount (estimated) required for repairs	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 17.)

18. Kingston Harbor, Massachusetts.—Kingston Harbor is one of the three divisions which together form Plymouth inner harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company's Wharf. No low-water channel of navigable dimensions existed to this wharf.

The project for the improvement was submitted May 25, 1891. It proposed to dredge a channel 100 feet wide, 6 feet deep at mean low water from deep water to the Cordage Company's Wharf, at an estimated cost of $10,000.

The total appropriations to date have been $10,000.

On September 16, 1892, a contract was entered into for the completion of the project. Operations under this contract were commenced in April, 1893, and satisfactorily completed in June, 1893.

At the date of this report the improved channel is completed in accordance with the project.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	1,374.54
July 1, 1893, balance unexpended	8,625.46
July 1, 1893, outstanding liabilities	7,563.10
July 1, 1893, balance available	1,062.36

(See Appendix B 18.)

19. Wellfleet Harbor, Massachusetts.—Wellfleet Harbor is 12 miles southeast of Provincetown, on Cape Cod Bay. Originally, no low-water channel to the town wharves existed. The object of its improvement is to provide a navigable channel from the inner anchorage, the "Deep Hole," to the town wharves.

The original project was submitted in 1871, and the present approved project was submitted on November 28, 1887. It proposes to dredge a channel from the "Deep Hole" to the town wharves, 4,200 feet long, 100 feet wide, and 6 feet deep at mean low water.

The total appropriations to date have been $16,000. The total amount expended to June 30, 1892, was $11,350.37, and at that date the channel connecting the "Deep Hole" with the town wharves was 25 feet wide and 4 feet deep at mean low water. Two hundred and four cubic yards of sunken rock had also been removed under the project of 1871.

No operations were in progress during the fiscal year, as the funds available were not considered sufficient to give any appreciable benefit to commerce, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

July 1, 1892, balance unexpended	$4,649.63
July 1, 1893, balance unexpended	4,649.63
Amount (estimated) required for completion of existing project	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	22,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 19.)

20. Provincetown Harbor, Massachusetts.—Provincetown Harbor is situated at the extremity of Cape Cod, about 40 miles southeast from Boston Light. It is one of the most valuable harbors of refuge on the Atlantic coast, the entire commerce of New England and a very large local fishing interest being directly interested in its maintenance, which depends entirely on the preservation of the sandy beaches which inclose it. Since 1826 the project has been a general one, and provides for the preservation of the harbor by building dikes, bulkheads and sand catches, and extensive planting of beach grass, to repair and prevent storm damages to the beaches. A special dike across House Point Island Flats, to be built contingently, was recommended in the annual report for 1886.

From the nature of the work it can at no time be considered completed.

The total appropriations to date have been $152,918.44.

The amount expended to June 30, 1892, was $147,635.09.

No active operations were in progress during the fiscal year and at the date of this report all the works of preservation are in good order with the exception of the sand catches at the west end of Abel Hill Dike, for the repair of which sufficient funds are available.

July 1, 1892, balance unexpended	$3,783.35
Amount appropriated by act approved July 13, 1892	1,500.00
	5,283.35
June 30, 1893, amount expended during fiscal year	42.40
July 1, 1893, balance unexpended	5,240.95
Amount (estimated) required for repairs	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 20.)

21. Chatham Harbor, Massachusetts.—Chatham Harbor is at the eastern end of Nantucket Sound, about 15 miles east of Hyannis, Mass.

Its outer anchorage (Chatham Roads) is a valuable harbor of refuge from northerly and easterly gales. The inner harbor (Stage Harbor) is small, but well landlocked, and has 8 to 12 feet depth at mean low water. Its entrance was obstructed by three bars, on which the greatest depth at mean low water was 4 feet.

The project for the improvement of this harbor, submitted December 19, 1890, proposes to dredge a channel through the three obstructing bars, 6 feet deep at mean low water, 100 feet wide at the inner bar, 150 feet wide at the middle bar, and 200 feet wide at the outer bar, at a cost of $10,000.

The total appropriations to date have been $5,000.

The expenditures to June 30, 1892, were $4,402.15. At that date the improved channel through the middle and inner bars was 100 feet wide, 6 feet deep at mean low water. Nothing had been done on the outer bar.

No operations were in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

July 1, 1892, balance unexpended	$597.85
July 1, 1893, balance unexpended	597.85
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix B 21.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. S. M. Mansfield, Corps of Engineers, and reports thereon submitted:

1. Gloucester Harbor, Massachusetts, from Five Pound Island to head of river.—Lieut. Col. Mansfield submitted report of examination under date of October 27, 1892. It is his opinion, concurred in by this office, that the locality is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $400. The report was transmitted to Congress, and printed as House Ex. Doc. No. 70, Fifty-second Congress, second session. (See also Appendix B 22.)

2. Vincent Cove, Gloucester Harbor, Massachusetts.—Lieut. Col. Mansfield submitted report of examination under date of October 27, 1892. It is his opinion, concurred in by this office, that the cove is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 56, Fifty-second Congress, second session. (See also Appendix B 23.)

3. Saugus River, Massachusetts.—Lieut. Col. Mansfield submitted report of examination under date of October 27, 1892. It is his opinion, concurred in by this office, that this river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 98, Fifty-second Congress, second session. (See also Appendix B 24.)

4. Chelsea River, Massachusetts, from Grand Junction Railroad Bridge to Boston and Maine (Eastern Division) Railroad Bridge.—Lieut. Col.

Mansfield submitted report of examination under date of October 26, 1892. It is his opinion, concurred in by this office, that the river is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $400. The report was transmitted to Congress and printed as House Ex. Doc. No. 40, Fifty-second Congress, second session. (See also Appendix B 25.)

5. *East Boston Channel, Massachusetts, from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad to the channel at Jeffries Point, so called.*—Lieut. Col. Mansfield submitted report of examination under date of October 27, 1892. It is his opinion, concurred in by this office, that the locality is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $200. The report was transmitted to Congress and printed as House Ex. Doc. No. 55, Fifty-second Congress, second session. (See also Appendix B 26.)

6. *Neponset River, Massachusetts.*—Lieut. Col. Mansfield submitted report of examination under date of October 31, 1892. It is his opinion, concurred in by this office, that the river is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 35, Fifty-second Congress, second session. (See also Appendix B 27.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS, IN RHODE ISLAND, AND IN EASTERN CONNECTICUT.

This district was in the charge of Capt. W. H. Bixby, Corps of Engineers, with Lieut. William W. Harts, Corps of Engineers, under his immediate orders; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. *Harbor of refuge at Hyannis, Mass.*—This harbor, before improvement, was an open roadstead, exposed to southerly storms. In the years 1827–1838 a breakwater of riprap granite 1,170 feet long was constructed, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15½ feet. Between the years 1852 and 1882 extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top.

The approved project of 1884 provides for the dredging to 15.5 feet depth at low water of about 34 acres of shoal area north of the existing breakwater, so as to increase the deep-water harborage by that amount; all at a total cost estimated in 1884 at $45,743.20 (including $81.20 left over from a former project), of which $28,081.20 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the 15.5 feet depth anchorage covered only about 47 acres, and the 34 additional acres to be dredged carried an average of about 12 feet depth of water at low water.

Eighty-one dollars and twenty cents was already on hand, $34,000 has since been appropriated, and $28,075.60 had been expended on this work up to June 30, 1892, by which 11 acres out of 34 had been dredged.

During the past fiscal year plans have been made for work under the new appropriations and contract for the dredging entered into, work (together with that at New Bedford) to be commenced by May 1 and completed October 1, 1893. Nothing but work of preparation has as yet been done in the field.

The balance on hand will be applied to dredging in the area protected by the breakwater.

July 1, 1892, balance unexpended		$5.60
Amount appropriated by act approved July 13, 1892		6,000.00
		6,005.60
June 30, 1893, amount expended during fiscal year		467.53
July 1, 1893, balance unexpended		5,538.07
July 1, 1893, outstanding liabilities	$66.10	
July 1, 1893, amount covered by uncompleted contracts	3,600.00	
		3,666.10
July 1, 1893, balance available		1,871.97

Amount (estimated) required for completion of existing project	11,662.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	11,662.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 1.)

2. Harbor of refuge at Nantucket, Mass.—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has deep water inside, and the object of improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod.

The approved project of 1880, as modified in 1885, provides for the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal current to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of 15 feet at low water in this channel; all at a total cost estimated in 1885 at $375,000, of which $170,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project no jetties existed and the channel entrance was barred by a shoal of 1.5 miles width, on which there was only 6 feet depth of water at low tide, the channel being very crooked and subject to changes in location.

One hundred and ninety-five thousand dollars has been appropriated and $169,886.58 had been expended on this work up to June 30, 1892, by which the west jetty had been built to 3,955 feet length with full height, the east jetty had been built to 834 feet length with full height, and, after a gap of 160 feet, 1,300 feet length had been raised to half-tide level.

During the past fiscal year plans have been made for work under the new appropriation. A minor survey was made to serve as basis for the coming season's work.

The balance available is to be applied to the further extension of the east jetty and raising low places in the west jetty, together with a little dredging if necessary.

July 1, 1892, balance unexpended	$113.42
Amount appropriated by act approved July 13, 1892	25,000.00
	25,113.42
June 30, 1893, amount expended during fiscal year	2,158.64
July 1, 1893, balance unexpended	22,954.78
July 1, 1893, outstanding liabilities	599.05
July 1, 1893, balance available	22,355.73

Amount (estimated) required for completion of existing project	$180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 2.)

3. Marthas Vineyard inner harbor at Edgartown, Mass.—The inner harbor at Edgartown lies in the northern part of the waterway or strait that separates Chappaquiddick Island from the east end of Marthas Vineyard. It extends southward about 1½ miles from Chappaquiddick Point opposite Edgartown, and averages about one-fifth of a mile in width.

This harbor is so completely landlocked as to form a safe harbor of refuge for small vessels, but the contracted width of the entrance and the resulting velocity of the tidal currents make it difficult to pass through.

The approved project of 1889 provides for the removal to 10 feet depth at low water of a "middle ground" shoal in the central part of the inner harbor, at a total cost estimated in 1889 at $4,500, of which $2,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the middle ground shoal carried only about 6 feet depth of water and was a very troublesome obstruction.

Four thousand five hundred dollars has been appropriated and $1,934.01 had been expended on this work up to June 30, 1892, by which about half of the shoal had been dredged to full depth.

During the year plans have been made for work under the new appropriations, all work to be done by hired labor and the use of the Government plant. A minor survey has been made to serve as a basis for the coming season's work. The dredging itself has been commenced and finished as far as funds allowed, a third quarter of the original shoal having been removed.

Further field work must await further appropriations. Two thouesand five hundred dollars more is still necessary, for reasons stated in full by the local engineer.

July 1, 1892, balance unexpended	$65.99
Amount appropriated by act approved July 13, 1892	2,500.00
	2,565.99
June 30, 1893, amount expended during fiscal year	2,333.60
July 1, 1893, balance unexpended	232.39
July 1, 1893, outstanding liabilities	126.54
July 1, 1893, balance available	105.85

Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 3.)

4. Harbor at Vineyard Haven, Mass.—Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound. The approved project of 1887, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled by the eroded material; the whole to be done by means of stone sea walls and jetties to be built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1882 at $60,000,

of which $35,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the headlands were gradually wearing away and the adjacent parts of the harbor were shoaling. No protection works were in existence.

Forty-two thousand five hundred dollars has been appropriated, and $34,904.03 had been expended on this work up to June 30, 1892, by which there had been built a sea wall of 450 feet length and a jetty of 50 feet length at the East Chop, and a sea wall of 400 feet length, three jetties of from 80 to 296 feet length, a wharf, and a short breakwater of 60 feet length at the West Chop.

During the past fiscal year plans have been made for work under the new appropriations and contract for stone work entered into; work to be commenced May 1 and completed by July 1, 1893. A minor survey has been made to serve as basis for the coming season's work. A few day's field work has been done by the contractor.

The balance available will be applied to continuing the work of protection at both chops.

July 1, 1892, balance unexpended		$95.97
Amount appropriated by act approved July 13, 1892		7,500.00
		7,595.97
June 30, 1893, amount expended during fiscal year		870.81
July 1, 1893, balance unexpended		6,725.16
July 1, 1893, outstanding liabilities	$219.05	
July 1, 1893, amount covered by uncompleted contracts	5,000.00	
		5,219.05
July 1, 1893, balance available		1,506.11
Amount (estimated) required for completion of existing project		17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		17,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 4.)

5. Wareham Harbor, Massachusetts.—The object of the improvement is to deepen and widen the channel leading from Buzzards Bay to Wareham. The commerce of Wareham is carried on in sailing vessels, and the channel is to be made a beating channel for such vessels. Another object of the improvement is the raising of Long Beach.

The approved project of 1880, as modified in 1887, provides for the deepening and widening of the channel from Buzzards Bay to Wareham, so as to obtain 10 feet depth at low water over 250 feet width from the entrance up to Barneys Point, and thence the same depth over 350 feet width up to Wareham; and for the raising and protecting of Long Beach (the eastern headland of the entrance) so as to prevent the erosion of this beach and the shoaling of the adjacent parts of the channel and harbor; all at a total cost estimated in 1887 at $56,236, of which $49,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the headland of Long Beach was wearing off and the adjacent parts of the channel and harbor were shoaling. The channel was narrow and crooked and limited to 9 feet depth at low water.

Fifty-six thousand two hundred and thirty-six dollars has been appropriated and $46,721.18 had been expended on this work up to June 30, 1892, by which the channel had been deepened to half width and full depth of 10 feet in its upper portion, and to less width in its lower

portions, and the sand spit had been partly protected by catch sand fences and brush and stone work.

The ruling depth of the approaches to Wareham had been increased from 7 to 9 feet, and the channel greatly widened in all the reaches. Vessels can be carried to Wareham with larger draft than formerly. The increase in width of channel had been a great help to all vessels in beating in and out of the harbor.

During the past fiscal year work of dredging has been carried on under an old contract completed on July 7. Plans have been made for further work under the new appropriation, allowing all work to be done by hired labor and the use of the Government plant. A minor survey has been started to serve as basis for the coming season's work.

July 1, 1892, balance unexpended	$2,278.82
Amount appropriated by act approved July 13, 1892	7,236.00
	9,514.82
June 30, 1893, amount expended during fiscal year	4,519.07
July 1, 1893, balance unexpended	4,995.75
July 1, 1893, outstanding liabilities	952.55
July 1, 1893, balance available	4,043.20

(See Appendix C 5.)

6. New Bedford Harbor, Massachusetts.—New Bedford Harbor is an estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fair Haven.

Before improvement the channel had a depth of about 12½ feet at mean low water. Old projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmer Island to the wharves at New Bedford. This work was completed in 1877 at a cost of $20,000.

The approved project of 1887 provides for the deepening, widening, and straightening of the channel from Buzzards Bay to New Bedford, so as to obtain 18 feet depth at low water, over 200 feet width, and over its entire length, at a total cost estimated in 1887 at $35,000, of which $20,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was winding and only about 15 feet deep.

Twenty-seven thousand five hundred dollars has been appropriated and $19,537.14 had been expended on this work up to June 30, 1892, by which the straight channel had been completed on its western side to 15 feet depth with 80 feet width over its entire length; and a slightly crooked channel of 80 feet width with 18 feet depth also existed over the same distance, wandering a little from the projected channel.

During the past fiscal year plans have been made for work under the new appropriation, and contract for the dredging entered into, work to be completed October 1, 1893. No work but preparation has as yet been done in the field.

The work required to complete the existing project is the excavation of the remaining half of the channel, 200 feet wide and 18 feet deep, extending from the vicinity of the wharves at New Bedford to the "11-foot bank," and the removal of a few shoal spots between the "11-foot bank" and Butlers Flats, the southern end of the projected channel.

The balance available will be applied to the continuation of this project.

July 1, 1892, balance unexpended		$462.86
Amount appropriated by act approved July 13, 1892		7,500.00
		7,962.86
June 30, 1893, amount expended during fiscal year		726.73
July 1, 1893, balance unexpended		7,236.13
July 1, 1893, outstanding liabilities	$38.56	
July 1, 1893, amount covered by uncompleted contracts	5,000.00	
		5,038.56
July 1, 1893, balance available		2,197.57

Amount (estimated) required for completion of existing project 7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 6.)

7. Westport Harbor, Massachusetts.—Westport Harbor is an estuary on the coast of Massachusetts, lying between Narragansett Bay, Rhode Island, and Buzzards Bay, Massachusetts. The site of the work is at Horse Neck Point (the north side of the entrance to the harbor).

Before the commencement of the improvement the site of the present work was a point of sand forming the northern and eastern boundary of the entrance to the harbor, and subject to erosion by the sea and tides.

In 1886 $1,000 was appropriated for special protection of Horse Neck Point. This work was completed in 1887.

The approved project of 1888 provides for the improvement of the channel from the Atlantic Ocean up the West Branch to Adamsville, up the East Branch to Westport Point so as to secure and maintain a channel depth of 7 feet at low water over its entire length, by dredging on the "Lion's Tongue" Shoal if necessary; and for the protection of Horse Neck Point (the eastern headland of the entrance) so as to prevent the erosion of this point and the shoaling of the adjacent parts of the channel and harbor; all at a total cost estimated in 1888 at $2,000, of which $1,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project, Horse Neck Point was gradually wearing away and the adjacent parts of the channel and harbor were shoaling.

Two thousand dollars has been appropriated and $662.19 had been expended on this work up to June 30, 1892, by which the headland had been protected by one jetty, 150 feet long, made of brush and stone.

During the past fiscal year plans have been made for work under new appropriation, all work to be done by hired labor and the use of the Government plant. A minor survey has been completed to serve as a basis for the coming season's work. The dredging itself has been commenced and finished as far as the funds allowed.

No further work is proposed.

July 1, 1892, balance unexpended	$337.81
Amount appropriated by act approved July 13, 1892	1,000.00
	1,337.81
June 30, 1893, amount expended during fiscal year	987.96
July 1, 1893, balance unexpended	349.85
July 1, 1893, outstanding liabilities	287.82
July 1, 1893, balance available	62.03

(See Appendix C 7.)

8. Canapitsit Channel, Massachusetts.—This waterway lies about 20 miles south of New Bedford, running between the islands of Cuttyhunk and Nashawena, and connecting the waters of Vineyard Sound and Buzzards Bay.

The object of the improvement is to make this channel safe for the use of light-draft sail boats, and also especially of the surf boats belonging to the life-saving station of this dangerous locality.

The approved project of 1891 provides for the widening and deepening of the present channel from Vineyard Sound to the ocean, between the islands of Nashawena and Cuttyhunk, Massachusetts, so as to secure a depth of 6 feet at low water with a least width of 150 feet over its entire length, at a total cost estimated in 1891 at $4,800.

At the adoption of the present project the sand shoals, and especially the numerous bowlders, made this passage specially dangerous to the life-saving-station boats and other shallow-draft row and sail boats.

Four thousand eight hundred dollars was appropriated for this work by act of July 13, 1892.

During the past fiscal year plans have been made for work under the appropriation, and the dredging itself has been commenced and completed as far as the funds provided allowed, a channel of about 66 feet width and at least 5 feet depth at low water having been cut entirely across the shoal, completing about half of the proposed work.

Further work in the field awaits further appropriations by Congress; $5,000 more is still necessary to complete the project, and the reasons for this increase in the amount required for the work are stated in full in the appended report of the local engineer.

Amount appropriated by act approved July 13, 1892	$4,800.00
June 30, 1893, amount expended during fiscal year	1,539.54
July 1, 1893, balance unexpended	3,260.46
July 1, 1893, outstanding liabilities	2,248.32
July 1, 1893, balance available	1,012.14
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 8.)

9. Taunton River, Massachusetts.—This river rises in Norfolk County, Mass., and empties into Narragansett Bay at Fall River. The object of the improvement is to deepen and widen the channel leading to the city of Taunton, at the head of navigation, so that vessels of 11 feet draft can reach the city at high water.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton the depth was not, in places, more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

From 1870 to 1879 $63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The approved project of 1880, as modified in 1888, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water with 100 feet width from its mouth up to Berkley Bridge (above Dighton), thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal, thence 11 feet depth with 80 feet width up to the shipyard, thence 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost

estimated in 1888 at $108,000, of which $101,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was limited to 9 feet at high water, and was too narrow and too much obstructed by bowlders for easy navigation by the craft making use of it.

One hundred and eight thousand dollars has been appropriated and $100,976.98 had been expended on this work up to June 30, 1892, by which a large part of the proposed work had been done, especially at the places most complained of by the vessels using this river. Vessels of 11 feet draft could reach Taunton, at the head of navigation.

During the past fiscal year plans have been made for work under the new appropriation, all work to be done by hired labor and the use of the Government plant. The dredging itself was commenced and completed as far as funds allowed, 5,050 cubic yards of dredged material and about 177 tons of bowlders having been removed from the most troublesome parts of the river above Briggs Shoal.

There remain, to complete the existing project, widening and deepening at a few points above the bridge and the removal of a small amount of ledge rock.

Further fieldwork must await further appropriations by Congress; $17,000 more is required for this work, and the reasons for this increase in the estimated cost are stated in full in the appended report of the local engineer.

July 1, 1892, balance unexpended	$23.02
Amount appropriated by act approved July 13, 1892	7,000.00
	7,023.02
June 30, 1893, amount expended during fiscal year	6,968.24
July 1, 1893, balance unexpended	54.78
July 1, 1893, outstanding liabilities	51.01
July 1, 1893, balance available	3.77
Amount (estimated) required for completion of existing project	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 9.)

10. Pawtucket River, Rhode Island.—This river, otherwise called Seekonk River, is the upper portion of Providence River, and extends from Pawtucket to Providence. Before improvement the channel in the river had a ruling depth of about 5 feet at mean low water.

Between 1867 and 1882 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876.

The approved project of 1883 provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth at Providence up to opposite Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth with 40 feet width through a stone ledge for a short distance farther to Pawtucket Bridge; all at a total cost estimated in 1883 at $382,500, of which $145,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was narrow and only about 5 feet deep.

One hundred and eighty thousand dollars has been appopriated and $144,295.12 had been expended on this work up to June 30, 1892, by which the shoalest places had been improved and about nine-tenths of the needed work done, securing a channel about 12 feet deep and from 40 to 100 feet wide (the greater portion being 100 feet wide) up to above the lower wharves of the city of Pawtucket.

This completed portion of the channel had been already a great benefit to the commerce of the river.

During the past fiscal year plans have been made for work under the new appropriation, and contract for dredging entered into, work to be completed April 1, 1894. A minor survey has been made to serve as basis for the coming season's work. No work, except of preparation, has as yet been done in the field.

The work yet to be done is to widen the channel for a short distance at two places and to deepen the channel through the ledge to the same depth with a width of 40 feet.

The balance available will be applied to continuing the improvement.

July 1, 1892, balance unexpended		$704.88
Amount appropriated by act approved July 13, 1892		35,000.00
		35,704.88
June 30, 1893, amount expended during fiscal year		1,256.65
July 1, 1893, balance unexpended		34,448.23
July 1, 1893, outstanding liabilities	$28.34	
July 1, 1893, amount covered by uncompleted contracts	13,860.00	
		13,888.34
July 1, 1893, balance available		20,559.89

Amount (estimated) required for completion of existing project	202,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 10.)

11. Providence River and Narragansett Bay, Rhode Island.—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence.

Before the improvement of the river was commenced in 1853 many shoals obstructed navigation, and at one point in the channel, a place called "The Crook," the available low-water depth was but 4½ feet. Between 1852 and 1873 $56,500 was appropriated to secure first 9 and then 12 feet depth of channel. This work was finished in 1873.

The approved project of 1878, as modified in 1882, provides for the deepening of the river and the deepening and widening of its anchorage basins, so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width, from Fox to Field Point; all at a total cost estimated in 1882 at $675,000, of which $560,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was limited to 12-foot depths, and the anchorage areas were much too small and shallow for the craft seeking them.

Six hundred and ten thousand dollars has been appropriated and $559,920.50 had been expended on this work up to June 30, 1892, by which all the 25-foot channels, most of the 20-foot anchorages, and a part of the 18-foot anchorages had been dredged, this being about five-sixths of all the proposed work.

During the past fiscal year plans have been made for work under the new appropriations, and contract for dredging entered into, work to be completed April 1, 1894. The dredging itself has been commenced and 76,421 cubic yards of material has been removed from the anchorage areas just above Sassafras Point.

There is required for the completion of the existing project the excavation of the anchorage basin between Sassafras Point and Field Point.

The balance available will be applied to the continuation of the work according to the project.

July 1, 1892, balance unexpended		$79.50
Amount appropriated by act approved July 13, 1892		50,000.00
		50,079.50
June 30, 1893, amount expended during fiscal year		4,177.78
July 1, 1893, balance unexpended		45,901.72
July 1, 1893, outstanding liabilities	$6,433.64	
July 1, 1893, amount covered by uncompleted contracts	31,318.76	
		37,752.40
July 1, 1893, balance available		8,149.32

Amount (estimated) required for completion of existing project	65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	65,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 11.)

12. Removal of Green Jacket Shoal, Providence River, Rhode Island.—This shoal is in that part of Providence River which constitutes the harbor of Providence. It lies off the wharves, on the south front of the city, and occupies a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves, and about 30 acres in all.

The approved project of 1885 provides for the removal to 25 feet depth, at low water, of a middle-ground shoal of about 30 acres area, in Providence River, opposite the city, the portion to be removed to be at least 200 feet distant from the harbor lines of the city; all at a total cost estimated in 1885 at $112,346, of which $79,250 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the shoal in many places carried only 1 foot of water, and was a very troublesome obstruction.

Eighty-nine thousand two hundred and fifty dollars has been appropriated and $79,231.92 had been expended on this work up to June 30, 1892, by which 18 acres out of the original 30 of this shoal had been removed to a depth of 25 feet at mean low water, making an important addition to the anchorage facilities of Providence Harbor.

During the past fiscal year plans have been made for work under the new appropriation, and contract for dredging was entered into, work to be completed April 1, 1894. No work, except of preparation, has as yet been done in the field.

The balance available will be applied to the continuation of the excavation of the shoal.

July 1, 1892, balance unexpended		$18.08
Amount appropriated by act approved July 13, 1892		10,000.00
		10,018.08
June 30, 1893, amount expended during fiscal year		342.45
July 1, 1893, balance unexpended		9,675.63
July 1, 1893, outstanding liabilities	$20.40	
July 1, 1893, amount covered by uncompleted contracts	7,500.00	
		7,520.40
July 1, 1893, balance available		2,155.23

Amount (estimated) required for completion of existing project	$23,096.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	23,096.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix C 12.)

13. Greenwich Bay, Rhode Island.—Greenwich Bay is an arm of Narragansett Bay, located in the towns of Warwick and East Greenwich, R. I. It has a length from northwest to southeast of about 3½ miles and an average width of 1½ miles.

The channel leading to the town of East Greenwich was originally deep enough for the present demands of commerce, but so crooked as to render navigation difficult.

The approved project of 1888 provides for the straightening and deepening of the channel from Narragansett Bay up to the town of East Greenwich, so as to secure a channel depth of 10 feet across the bar extending out from Long Point; all at a total cost estimated in 1888 at $2,000, of which the whole was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was narrow, crooked, and shoaly.

Two thousand dollars has been appropriated and $1,999.68 had been expended on this work up to June 30, 1892, by which the obstruction had been fairly well removed. All dredging was completed in May, 1891, leaving a channel of 10 feet depth with 210 feet width and 500 feet length opposite Long Point, where the channel had previously been most narrow and crooked.

Nothing but minor office work has been done during the past year. Nothing further is proposed or needed.

July 1, 1892, balance unexpended	$0.32
June 30, 1893, amount expended during fiscal year	0.32

(See Appendix C 13.)

14. Cove and waterway near Coaster Harbor Island, Rhode Island.—This cove is situated in the northwestern part of the city of Newport, R. I., near the southeastern extremity of Coaster Harbor Island, which is occupied by the U. S. Navy as a training station. A causeway connecting Coaster Harbor Island with Rhode Island forms the northern boundary of the cove and separates it from the waterway above. This causeway, having but one small opening, has checked the flow of water around the island and caused deposits, so filling the waterway as to cause it to give forth unhealthy and disagreeable odors.

The approved project of 1889 provides for the deepening of the cove and the waterway from Newport Harbor up to the causeway crossing the cove, and for the cutting of additional openings in the causeway, so as to allow of the freer flow of water through the waterway between Coaster Island and the mainland; all at a total cost estimated in 1889 at $5,500, which was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the cove was badly shoaled in some places, and the passage through the causeway was limited to 25 feet width and 1 foot depth at low tide.

Five thousand five hundred dollars has been appropriated and $3,500.91 had been expended on this work up to June 30, 1892, this expenditure resulting in the completion of the dredging in the cove and the construction of four small bridge trusses.

During the past fiscal year a cut of 120 feet total width was made through the causeway, and covered by a bridge of four small spans of 30 feet each.

17. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow-draft salt pond, lying in rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is the reopening of an old entrance long ago closed by the ocean storms.

At the date of the present appropriation, made in 1892, the entrance to this pond was very shallow (less than 3 feet), crooked, and variable in location.

During the past fiscal year the locality has been again examined under provisions of the river and harbor act approved July 13, 1892, and reported as not worthy of improvement by the General Government.

It is probable that the expenditure of the balance of this appropriation, at this place at present, would not produce any permanent or useful improvement to the pond entrance.

Amount appropriated by act approved July 13, 1892	$7,500.00
June 30, 1893, amount expended during fiscal year	67.87
July 1, 1893, balance unexpended	7,432.13
July 1, 1893, outstanding liabilities	10.72
July 1, 1893, balance available	7,421.41

(See Appendix C 17.)

18. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor which afforded protection for decked vessels.

Between 1870 and 1876, $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882, $25,000 was appropriated for an inner basin and the protection of the shore next the breakwater, this work being completed in 1884. In 1884, $15,000 was appropriated for additions to the old breakwater, this money being so spent in 1884–'85.

The approved project of 1884, as modified in 1888, provides for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) for small vessels and an exterior harbor for large ones. The basin was to be about 800 feet square and completely inclosed except at its 100-feet-wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west; but an old gap near the end of this breakwater was to be filled up. The project covers the construction of the stone sea walls of the enlarged inner harbor ($46,000) the repair of the old breakwater ($24,000) and a little dredging ($5,000), along the western side of the old breakwater and also inside the harbor; all at a total cost estimated in 1888 at $75,000, of which $50,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project, this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

Seventy-four thousand dollars has been appropriated, and $49,886.03

Amount (estimated) required for completion of existing project	$26,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	26,700.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 15.)

16. Harbor of refuge at Point Judith, Rhode Island.—Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid Ledge, extends for nearly a mile in a south-by-easterly direction about 1½ miles west of the Point.

The approved project of 1889 provides for the construction of a national harbor of refuge nearly a mile square at this point by means of stone breakwaters, planned so as to give protection against eastern, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000, of which $75,000 was appropriated prior to the commencement of the fiscal year.

By the act of July 13, 1892, authority was given to the Secretary of War to make contracts for the completion of the project, on the basis of the above-estimated total cost, the work to be paid for as appropriations may from time to time be made by law.

At the adoption of the project this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

Two hundred and fifty thousand dollars has been appropriated, and $73,249.74 had been expended on this work up to June 30, 1892, by which quarries had been opened, special plant had been built, and the breakwater had been commenced at its center, about 200 feet length raised to about low-water level, and a beacon light established thereon.

During the past fiscal year full plans have been made for the entire improvement, and contract for the whole has been entered into, work to be commenced July 15, 1893, and each year's future appropriation expended before the end of the next season thereafter. A minor survey has been made to serve as basis for future work. The contractor has been preparing for active fieldwork.

It is proposed to apply the balance available and the appropriation asked for to continuing the construction of the breakwater.

July 1, 1892, balance unexpended		$1,750.26
Amount appropriated by act approved July 13, 1892		75,000.00
Amount appropriated by sundry civil act approved March 3, 1893		100,000.00
		176,750.26
June 30, 1893, amount expended during fiscal year		2,097.86
July 1, 1893, balance unexpended		174,652.40
July 1, 1893, outstanding liabilities	$616.46	
July 1, 1893, amount covered by uncompleted contracts	132,000.00	
		132,616.46
July 1, 1893, balance available		42,035.94

Amount (estimated) required for completion of existing project	1,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C 16.)

17. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow-draft salt pond, lying in rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is the reopening of an old entrance long ago closed by the ocean storms.

At the date of the present appropriation, made in 1892, the entrance to this pond was very shallow (less than 3 feet), crooked, and variable in location.

During the past fiscal year the locality has been again examined under provisions of the river and harbor act approved July 13, 1892, and reported as not worthy of improvement by the General Government.

It is probable that the expenditure of the balance of this appropriation, at this place at present, would not produce any permanent or useful improvement to the pond entrance.

Amount appropriated by act approved July 13, 1892	$7,500.00
June 30, 1893, amount expended during fiscal year	67.87
July 1, 1893, balance unexpended	7,432.13
July 1, 1893, outstanding liabilities	10.72
July 1, 1893, balance available	7,421.41

(See Appendix C 17.)

18. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor which afforded protection for decked vessels.

Between 1870 and 1876, $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882, $25,000 was appropriated for an inner basin and the protection of the shore next the breakwater, this work being completed in 1884. In 1884, $15,000 was appropriated for additions to the old breakwater, this money being so spent in 1884–'85.

The approved project of 1884, as modified in 1888, provides for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) for small vessels and an exterior harbor for large ones. The basin was to be about 800 feet square and completely inclosed except at its 100-feet-wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west; but an old gap near the end of this breakwater was to be filled up. The project covers the construction of the stone sea walls of the enlarged inner harbor ($46,000) the repair of the old breakwater ($24,000) and a little dredging ($5,000), along the western side of the old breakwater and also inside the harbor; all at a total cost estimated in 1888 at $75,000, of which $50,000 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project, this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

Seventy-four thousand dollars has been appropriated, and $49,886.03

had been expended on this work up to June 30, 1892, by which the gap in the old breakwater had been filled up so as to make the breakwater of 1,900 feet total length; the north sea wall had been built to 170 feet length with full height, then came a gap of 190 feet length, then 130 feet length to full height, then 100 feet length to high-water level, and then 150 feet length to low-water level; the west sea wall had been started for 50 feet at its shore end; and the shoal west of the breakwater had been dredged to a depth of 9 feet from the steamboat wharf to within 100 feet of the north wall.

During the past fiscal year plans have been made for work under the new appropriations, and contract for the stone work and fender piers entered into, work to be completed by October 1, 1893. A minor survey has been made to serve as basis for the coming season's work. A few days' field work has been done by the contractor.

The balance on hand will be applied to the continuation of the work under the existing project.

July 1, 1892, balance unexpended		$113.97
Amount appropriated by act approved July 13, 1892		24,000.00
		24,113.97
July 1, 1893, balance unexpended		1,735.75
June 30, 1893, amount expended during fiscal year		22,378.22
July 1, 1893, outstanding liabilities	$2,959.72	
July 1, 1893, amount covered by uncompleted contracts	11,807.60	
		14,767.32
July 1, 1893, balance available		7,610.90
Amount (estimated) required for completion of existing project		1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix C 18.)

19. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends from the town of Westerly to Little Narraganset Bay, and the object of the improvement is to deepen and widen this channel.

Before improvement, the channel was crooked and obstructed by numerous shoals, on some of which there was but 1½ feet of water at mean low water.

Between 1871 and 1876 $50,000 was appropriated for the excavation of a channel 5½ feet deep at mean low water and 75 feet wide below the wharves, and from 35 to 40 feet wide between the upper and lower wharves, this work being completed in 1876.

The approved project of 1885, as modified in 1892, provides for the deepening and widening of the river so as to secure a channel of at least 8 feet depth at low water, with 100 feet width from its mouth up to the lower wharves of Westerly, and thence a channel of the same depth with about 40 feet width up to the upper wharves of the city; all at a total cost estimated in 1891 at $42,400, of which $38,600 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the channel was limited to 5.5 feet depth, over 75 feet width below the city, and the same depth over 35 feet width opposite the city; and rock ledges covered the channel at several points.

Forty-one thousand eight hundred dollars has been appropriated and $37,846.06 had been expended on this work up to June 30, 1892, by which the 8-foot channel had been completed from deep water upward for full width to within a half mile of the city, and for partial width for the remaining distance; and the rock ledge obstructions had been removed from the channel below the city.

During the past fiscal year plans have been made for work under the new appropriation, all work to be done by hired labor and the use of the Government plant. No work, except of preparation, has as yet been done in the field.

The balance available will be applied to the extension of the channel according to the project.

July 1, 1892, balance unexpended	$753.94
Amount appropriated by act approved July 13, 1892	3,800.00
	4,553.94
June 30, 1893, amount expended during fiscal year	1,407.19
July 1, 1893, balance unexpended	3,146.75
July 1, 1893, outstanding liabilities	78.87
July 1, 1893, balance available	3,067.88

(See Appendix C 19.)

20. Harbor of refuge at Stonington, Conn.—Stonington Harbor lies on the north side of the eastern entrance from the ocean into Long Island Sound, and its breakwaters are for the purpose of making the harbor a harbor of refuge for vessels entering and leaving this eastern entrance of the sound. Stonington Harbor originally was an open bay unprotected from southerly storms and obstructed by a shoal having a low-water depth of but 6 feet at the shoalest part. Between 1827 and 1831 about $37,000 was spent in constructing piers or breakwaters in the inner harbor for the protection of the general harborage. Between 1871 and 1873 $46,166 was appropriated for a survey of the harbor and for dredging the harbor to 12 feet depth, this work being finished in 1875. Between 1875 and 1879 $112,500 was appropriated for the construction of a western breakwater about 2,000 feet long, extending to 18 feet depth of water, and for dredging the harborage to 12 feet depth inside this breakwater, this work being completed in 1880.

The approved project of 1880, as modified in 1882, provides for the construction of an eastern breakwater as a protection to the outer harbor, this breakwater, about a half mile long, to extend from the vicinity of Bartlett's Reef to the vicinity of the Middle Ground Shoal or until it gives sufficient protection to the harbor against southerly winds; all at a total cost estimated in 1882 at $143,000, of which $130,500 was appropriated prior to the commencement of the fiscal year.

At the adoption of the present project the harbor had no eastern breakwater.

One hundred and forty-three thousand dollars has been appropriated and $130,461.42 had been expended on this work up to June 30, 1892; this expenditure resulted in the extension of this eastern breakwater to a total length of 2,377 feet.

During the past fiscal year nothing but office work and minor field work was done, further breakwater construction being postponed to await the result of new surveys.

The balance on hand will be expended in extending the eastern breakwater.

July 1, 1892, balance unexpended	$38.58
Amount appropriated by act approved July 13, 1892	12,500.00
	12,538.58
June 30, 1893, amount expended during fiscal year	600.90
July 1, 1893, balance unexpended	11,937.68
July 1, 1893, outstanding liabilities	79.29
July 1, 1893, balance available	11,858.39

(See Appendix C 20.)

21. Removing sunken vessels or craft obstructing or endangering navigation—a. Wreck of schooner J. B. Woodbury.—This vessel, wrecked in about 1875, was reported in April, 1892, as lying about 2 miles south of the life saving station at Monomoy, Southern Cape Cod, Massachusetts, and as endangering the safety of the life-saving boats and other craft. The wreck was removed by contract completed July 29, 1892.

b. Wreck of schooner Bertha J. Fellows.—This vessel, wrecked in about 1885, was reported in April, 1892, as lying about three-quarters of a mile north of the life-saving station at Monomoy, Southern Cape Cod, Massachusetts, and as endangering the safety of the life-saving boats and other craft. The wreck was removed by contract completed July 24, 1892.

c. Wreck of schooner Davis Brothers.—This vessel, loaded with lime, and on fire, was scuttled, stripped, and left by her owners, in June, 1891, in Dutch Island Harbor, Narragansett Bay, Rhode Island. The wreck was removed by hired labor, work being completed in October, 1892.

d. Wreck of schooner Francis Edward.—This vessel, loaded with lumber, found adrift in Vineyard Sound, Massachusetts, was towed into port and run aground, stripped, and left by her finders and owners, in May, 1892, in Fairhaven Harbor, Massachusetts. The wreck was removed by hired labor, work being completed in March, 1893.

e. Wreck of schooner G. S. Tarbell.—This vessel, loaded with plaster, was sunk by collision in November, 1892, about 5 miles southeast of Vineyard Sound Lightship, Massachusetts. Her spars and rigging were removed to 65 feet depth at low water by hired labor, work being completed in March, 1893.

f. Wreck of coal barge Sooloo.—This barge, loaded with coal, and endeavoring to avoid collision with the wreck of the steam yacht *Alva*, itself struck on the shoals and sunk in November, 1892, near the bell buoy in Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachussetts. The wreck was removed by hired labor, work being completed in April, 1893.

g. Wreck of coal barge Storm King.—This barge, loaded with coal, and endeavoring to avoid collision with the wreck of the steam yacht *Alva*, itself struck on the shoals and sunk in November, 1892, near the bell buoy in Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachusetts. The wreck was removed by hired labor, work being completed in April, 1893.

h. Wreck of barge R. A. Allen.—This barge, loaded with coal, stranded in 1867, on Handerchief Shoal, near Monomoy Point, Southern Cape Cod, Massachusetts, was reported in December, 1892, as having recently caused damage to other boats. The wreck was removed by hired labor, work being completed in April, 1893.

i. Wreck of schooner Charlotte Fish.—This schooner, loaded with

coal, foundered in December, 1892, about 4 miles south of Monomoy Light-House, Southern Cape Cod, Massachusetts. The wreck was removed by contract completed April 26, 1893.

j. Old wreck in Nantucket Harbor.—A schooner, stranded a few years ago on the beach of Coatue Point, outside the Nantucket (Mass.) Harbor jetties, was cut to pieces by the ice of the past winter and a portion of the hull was in the spring of 1893 carried over the east jetty into the main channel entrance to Nantucket Harbor. This obstruction was removed by hired labor, work being completed in June, 1893.

k. Old wreck in Edgartown Harbor.—A schooner, sunk a few years ago on the shore of the eastern side of Edgartown Harbor, Massachusetts, was cut down by the ice of the past winter in such a way as to be complained of, in May, 1893, as dangerous to navigation. The wreck was removed by hired labor, work being completed in June, 1893.

l. Wreck of steam yacht Alva.—This steam yacht, on a pleasure trip, was sunk by collision in July, 1892, in the middle of Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachussetts. Her owners were allowed the two months guaranteed them by law in which to remove her. After this time the wreck was duly advertised and her removal awarded to the lowest bidder under contract dated December 12, work to be completed by May 14, 1893. Unusual stress of weather during the winter caused this time to be extended until July 14, 1893. Work was practically finished on June 30.

m. Wreck of old stone schooner at Monomoy Point.—This schooner, loaded with stone, sunk several years ago on the southern edge of Shovelful Shoal, Monomoy Point, Southern Cape Cod, Massachusetts, had, in 1893, become a dangerous obstruction to navigation. The wreck is now under removal by hired labor.

n. Wreck of schooner Nellie V. Rokes.—This schooner, loaded with stone, sunk in 1890 about 0.5 mile southeast of the Monomoy Life-Saving Station, Southern Cape Cod, Massachussetts, had, in 1893, become a dangerous obstruction to navigation. The wreck is now under removal by hired labor.

o. Wreck of schooner Rogers.—This schooner, loaded with coal, was stranded, in April, 1893, in the slue of Handkerchief Shoal about 1.5 miles southwest of Monomoy Point, Southern Cape Cod, Massachusetts. The wreck is now under removal by hired labor.

The cost of the work on the wrecks removed during the year was $13,692.84.

(See Appendix C 21.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. W. H. Bixby, Corps of Engineers, and reports thereon submitted through the division engineer, Col. Henry L. Abbot, Corps of Engineers:

1. Woods Holl, Mass.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the channel between Buzzards Bay and Vineyard Sound, near Woods Holl, is worthy of improvement by the United States. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $1,200. (See Appendix C 22.)

2. For breakwater at Tarpaulin Cove, Naushon Island, Massachusetts.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this cove is worthy of improvement by the General Government. The cost of a survey necessary for preparation of project and estimate for improvement is estimated at $1,000. (See Appendix C 23.)

3. New Bedford Harbor, Massachusetts.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this harbor is worthy of an enlargement of the anchorage area, in addition to the improvements heretofore made by the General Government. The cost of a survey for preparation of project and estimate of the cost of the additional improvement is estimated at $500. (See Appendix C 24.)

4. Pawtuxet Harbor, Providence River, Rhode Island.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the United States. (See Appendix C 25.)

5. Apponaug Harbor, Cowesset Bay, Rhode Island.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this harbor is not worthy of improvement by the General Government. (See Appendix C 26.)

6. Greenwich Harbor, Greenwich Bay, Rhode Island.—Capt. Bixby submitted report of examination under date of June 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that Greenwich Harbor is not worthy of improvement by the General Government. (See Appendix C 27.)

7. Wickford Harbor, Narragansett Bay, Rhode Island.—Capt. Bixby submitted report of examination under date of June 10, 1893. He considers the locality worthy of a moderate degree of improvement by the General Government; and the division engineer recommends that a survey, not to cost over $200, be made to determine whether the channel may not be worthy of further widening and improvement. In the opinion of this office the locality is worthy of such moderate improvement as the survey recommended by Col. Abbot may show to be warranted. (See Appendix C 28.)

8. Inner harbor at Point Judith Breakwater, Rhode Island.—Capt. Bixby submitted report of examination under date of June 12, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this improvement is not worthy of being made by the United States. (See Appendix C 29.)

9. Breachway into Salt Pond, Block Island, Rhode Island.—Capt. Bixby submitted report of examination under date of June 12, 1893. The improvement desired is the conversion of the pond in Block Island into a national harbor of refuge by establishing a connection with the ocean on the west side. It is the opinion of Capt. Bixby and of the division engineer, concurred in by this office, that this improvement is not worthy of being undertaken by the General Government. (See Appendix C 30.)

10. Stonington Harbor and the entrance thereto, Connecticut.—Capt. Bixby submitted report of examination under date of June 12, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this harbor is worthy of further improvement by the United

States, in addition to that already made and under way. The cost of a survey necessary for preparing project and estimate of cost of improvement is estimated at $1,200. (See Appendix C 31.)

IMPROVEMENT OF CONNECTICUT RIVER AND OF RIVERS AND HARBORS IN CONNECTICUT AND NEW YORK TRIBUTARY TO LONG ISLAND SOUND, AND ON SOUTHERN SHORE OF LONG ISLAND.

This district was in the charge of Col. D. C. Houston, Corps of Engineers, until May 18, 1893, and of Lieut. Col. Henry M. Robert, Corps of Engineers, since June 12, 1893, with Lieut. Thomas H. Rees, Corps of Engineers, under their immediate orders since April 5, 1893, and in the temporary charge of Lieut. Rees from May 18 to June 12, 1893.

1. Mystic River, Connecticut.—This is a tidal river about 4 miles in length, extending northward from Fishers Island Sound. Its natural depth for the lower 2 miles was 15 feet or more at low tide, in a very crooked and narrow channel; thence for a mile farther, to the village of Mystic, the depth shoaled to about 9 feet.

Above Mystic there has been little navigation. In 1888 an examination of the river was made, and subsequently a project was adopted for dredging to carry the depth of 15 feet at mean low water, with width of 100 feet, up to the highway bridge, and to widen five bends in the stream, at an estimated cost of $30,000.

Up to July 1, 1892, $9,774.40 had been expended on this improvement, in dredging to make an available depth of 15 feet at mean low water up to Mystic, where the previous depth had been 9 feet, and the sharp bend, at the mouth of the river, was widened by 25 to 75 feet.

During the past fiscal year the channel at and above the upper one of the five bends has been dredged to the required depth and width, and the widening of the second bend nearly completed: the latter work will be finished during the present season with the remainder of the appropriation.

The total amount appropriated for this improvement is $20,000.

Future appropriations will be applied to dredging, to widen the channel at the lower bends, as provided in the project.

July 1, 1892, balance unexpended	$225.60
Amount appropriated by act approved July 13, 1892	10,000.00
	10,225.60
June 30, 1893, amount expended during fiscal year	6,576.57
July 1, 1893, balance unexpended	3,649.03
July 1, 1893, amount covered by uncompleted contracts	3,280.56
July 1, 1893, balance available	368.47
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 1.)

2. Thames River, Connecticut.—This river is a tidal stream extending from the city of Norwich 15 miles south to Long Island Sound. For 11 miles above its mouth the depth ranges from 13 to 80 feet.

Until 1889 improvements were confined to a stretch of 3½ miles below Norwich, in which the most troublesome bars lay. In 1829, the channel depth over these bars was about 6 feet at mean low water.

In 1836 a project was adopted for making the channel 100 feet wide

and 14 feet deep at mean high water (11 feet at low water), by dredging and by building piers.

In 1878 a channel 14 feet deep at low water was projected, and in 1882 a modification was adopted providing for a channel 200 feet wide and 14 feet deep at mean low water, to be obtained by dredging and by building five dikes or training walls along the outer sides of the channel curves. The estimated cost was $208,080, and a balance of $20,000 from previous appropriations was then available. In 1888 the project was extended to include making 16 feet depth as far as Allyn Point, and 14 feet from there to Easter Point at an additional cost of $40,000.

Under the provisions of the river and harbor act of July 13, 1892, $10,000 of the appropriation for Thames River is authorized to be expended in the improvement of Shaws Cove, New London, and the total estimated cost of this additional work, $48,000, has been added to the estimate required for completion of the existing project for the improvement of the river. The original depth in this cove was from 2½ to 8 feet at mean low water, and the channel was narrow and crooked. The project provides for making a channel 100 feet wide and 12 feet deep, with an anchorage basin of the same depth, 800 by 400 feet.

Up to July 1, 1892, three of the proposed dikes had been completed, and the fourth one nearly so; and the channel had an available depth from Norwich to Easter Point (3½ miles) of nearly 12 feet, with width of 75 to 125 feet; from Easter Point to Allyn Point, 14 feet depth with 175 feet width; below Allyn Point 16 feet depth with 200 feet width. At extreme high water the depth was sufficient for the commerce of the river, but the channel was too narrow for convenience and safety.

No work had been done in Shaws Cove.

The total amount expended in improving Thames River, Connecticut, up to July 1, 1892 was $369,759.05.

During the past fiscal year, the widening and deepening of the channels in the upper part of the river was begun, under a contract still in progress; the channel in Shaws Cove was made the full length and depth with width of 60 feet and the anchorage basin at the bend was begun.

The addition of the improvement of Shaws Cove, New London Harbor, to this project, increases the present estimate for completion of project from $55,600 to $93,600.

July 1, 1892, balance unexpended		$4,540.95
Amount appropriated by act approved July 13, 1892		30,000.00
		34,540.95
June 30, 1893, amount expended during fiscal year		10,489.50
July 1, 1893, balance unexpended		24,051.45
July 1, 1893, outstanding liabilities	$9,244.36	
July 1, 1893, amount covered by uncompleted contracts	9,236.50	
		18,480.86
July 1, 1893, balance available		5,570.59

Amount (estimated) required for completion of existing project	93,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 2.)

3. Connecticut River, Massachusetts and Connecticut.—Above Hartford.—From Holyoke, Mass., 34 miles above Hartford, down to Enfield

Falls or Rapids, a distance of 18 miles, there is a fair channel 4 to 5 feet deep.

Enfield Rapids extends about 5 miles over a rocky and uneven bed, with a total fall of 32 feet. From the foot of Enfield Rapids to Hartford, a distance of 11 miles, the river's bed is broad and sandy, with a channel from 2 to 5 feet deep at low water.

Several years ago the Connecticut River Company constructed a small canal around Enfield Rapids, through which boats of 3 feet draft and 80 feet length can pass.

The several projects under which work has been done have been for dredging at Barbers Landing and for wing dams. In 1878 plans and estimates were submitted for construction of a canal 8 feet deep around Enfield Rapids. These estimates were revised in 1880. The estimated cost of the canal was $1,322,805. It was not considered advisable to commence construction with a less sum than $450,000, which has not yet been appropriated.

Up to the close of the present fiscal year $100,000 has been appropriated for this part of the river, of which $91,059.70 has been expended. All the work done has been dredging, and the construction and repair of 7 wing dams.

No work was done during the past fiscal year.

The last appropriation for this part of the river was made in 1880, and the last work done was repair of wing dams in 1886. Except the fixing and defining of the channel by wing dams, the results of the improvement so far made have not been permanent.

The funds on hand from previous appropriations are sufficient for such repairs and temporary improvement as may be needed during the ensuing fiscal year; no other work is at present contemplated.

July 1, 1892, balance unexpended	$8,940.30
July 1, 1893, balance unexpended	8,940.30

Connecticut River below Hartford.—Between Hartford and Long Island Sound, a distance of 50 miles by course of channel, the depth on the bars was formerly 5 feet at low water, the worst places being between Hartford and Middletown, a distance of 19 miles, and at Saybrook Bar at the mouth of the river. Dredging was carried on and small wing dams were constructed by private parties, and by a State corporation up to 1868, with no permanent benefit.

In 1868 a project for improvement by the United States was submitted, under which a pile dike was built at Hartford, and annual dredging done on the bars below Hartford, until 1883.

In 1873 a project for the construction of three jetties on Saybrook Bar was adopted. Two of these have been built; the third will probably not be required.

In 1880 a project for permanent improvement of six of the worst bars between Hartford and Middletown was adopted; it contemplated building riprap wing dams, rectifying the banks, and protecting the caving banks by mattresses, at a total estimated cost of $330,487. It was, afterwards, found necessary to extend the project to include annual dredging at these and other bars, and the extension and repair of the Saybrook jetties.

Two of the contemplated works have been built, a training wall at Hartford Bar, and a wing dam at Glastonbury Bar, their total cost being $40,715.34. In addition to the work included in the estimate of $330,487, the east and west jetties at Saybrook have been extended and repaired, and a channel 130 feet wide and 12 feet deep has been

dredged between them, and from $5,000 to $10,000 has been annually expended in dredging to maintain a depth of 9 feet on the bars between Hartford and Saybrook.

Experience has shown that on account of the frequency and height of freshets in this river, the permanent works projected in 1880 would be inadequate to maintain the desired depth, or even to materially reduce the amount of dredging annually required. Therefore, in December, 1887, a new project was adopted, confining future operations to the completion of the Saybrook jetties to a height of 5 feet above high water, with a top width of 6 feet, and widening the channel between the jetties to 400 feet, with a depth of 12 feet at mean low water, at an estimated cost of $80,000, with annual dredging to maintain a 9-foot channel between Hartford and Long Island Sound at an average cost of $10,000 per year.

In 1890 an extension of the project was adopted to provide for raising the Hartford Dike to about 15 feet above low-water level, at an additional estimated cost of $50,000.

Up to July 1, 1892, riprap dikes had been built at Hartford and Glastonbury bars, two riprap jetties at Saybrook Bar, at the river's mouth, a channel 130 feet wide and 12 feet deep had been dredged through Saybrook Bar, and channels of 9 feet depth had been made, and, as far as practicable, maintained by annual dredging.

The Hartford dike and jetties at Saybrook are in good condition, the jetties have secured the permanency of the entrance channel, and the dike has partly secured the channel at Hartford Bar; the Glastonbury Dike is mostly covered by sand. The channel at the entrance retains nearly full width and depth.

During the fiscal year dredging was done to maintain the navigable channels in the river, and work is now in progress, removing the shoals which formed during the spring freshets. The appropriation of 1892 has been, and will be, applied wholly to annual maintenance of channels, and will not reduce the estimate for completion of permanent work. Dredging early in each year to restore the channels filled by spring freshets is imperatively necessary for the commerce of this river, and should be done whenever funds are available, in preference to the projected permanent improvements. Since this part of the project has been definitely adopted and put in practice, the river has been on the average in much better navigable condition that before.

Future appropriations will be applied to the maintenance of the 9-foot channels, necessary for navigation of the river, to raising the Hartford Dike, and completing the Saybrook jetties, and to widening the channel at Saybrook Bar.

July 1, 1892, balance unexpended		$386.06
Amount appropriated by act approved July 13, 1892		20,000.00
		20,386.06
June 30, 1893, amount expended during fiscal year		3,646.03
July 1, 1893, balance unexpended		16,740.03
July 1, 1893, outstanding liabilities	$2,284.89	
July 1, 1893, amount covered by uncompleted contracts	12,903.12	
		15,188.01
July 1, 1893, balance available		1,552.02

Amount (estimated) required for completion of existing project	110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	90,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 3.)

4. Harbor of refuge at Duck Island Harbor, Connecticut.—This harbor is a broad bay on the north side of Long Island Sound, about midway between the harbors of New Haven and New London, a distance of 46 miles in the widest part of the Sound, where there is no sufficient harbor of refuge for general commerce. Duck Island Harbor is large enough for such use, but is naturally unprotected from storms from any southerly quarter.

By order of Congress, examinations of this harbor were made in 1883 and 1886, and subsequently a project was adopted for making it a harbor of refuge by constructing three riprap breakwaters, the west one extending westerly from Duck Island, the middle one extending northeasterly from Duck Island, the east one extending southwesterly from Menunketesuck Point to the east limit of the harbor. The total length of these breakwaters was to be 5,880 feet and their estimated cost is $463,540.

Work under this project was begun in May, 1891, and up to July 1, 1892, 946 linear feet of the west breakwater had been built, extending it westwardly from Duck Island to a depth of 15 feet at mean low water. At this length it affords a limited shelter from southeast and south storms.

During the past fiscal year the work has been extended about 294 feet, making it 1,240 feet long, and under the existing contract it will be further extended to a total length of about 2,000 feet.

The total amount appropriated for this improvement is $60,000.

It is proposed to continue breakwater construction under future appropriations.

July 1, 1892, balance unexpended		$1,315.10
Amount appropriated by act approved July 13, 1892		35,000.00
		36,315.10
June 30, 1893, amount expended during fiscal year		3,449.92
July 1, 1893, balance unexpended		32,865.18
July 1, 1893, outstanding liabilities	$5,252.39	
July 1, 1893, amount covered by uncompleted contracts	23,062.57	
		28,314.96
July1, 1893, balance available		4,550.22

Amount (estimated) required for completion of existing project 403,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 4.)

5. Clinton Harbor, Connecticut.—This harbor is 10 miles west of the mouth of the Connecticut River. Its channel runs for nearly a mile inside of a beach, through which a breach was made about the year 1840, after which the channel shoaled in two places to about 4 feet depth where it had been 8 feet deep.

The project for improvement adopted in 1882 provided for closing the breach, and, if that did not restore the channel depth, for dredging a channel 100 feet wide and 6 feet deep at mean low water through the shoals. The entire cost was estimated at $10,000.

A riprap dike was built across the breach in 1883 and repaired in 1892. July 1, 1892, the dike was in good condition; no dredging had been done, and the channel had not deepened since 1882.

During the past fiscal year a channel 6 feet deep at mean low water was dredged with 85 feet width through the inner bar and 75 feet width

through the outer bar. This affords all the relief that the commerce of the harbor needs at present.

In 1893 the project was modified to make the width sought 75 feet and the total cost for completion $8,500. This project is completed.

No appropriation will be required for the ensuing year.

July 1, 1892, balance unexpended	$1,582.75
Amount appropriated by act approved July 13, 1892	2,000.00
	3,582.75
June 30, 1893, amount expended during fiscal year	3,338.97
July 1, 1893, balance unexpended	243.78

(See Appendix D 5.)

6. New Haven Harbor, Connecticut.—The original available low-water depth up to the wharves in this harbor was about 9 feet.

The first project for deepening the channel provided for making it 13 feet deep, which was done in 1871. It was widened at different times until 1878, when a project was adopted for dredging a channel 16 feet deep and not less than 400 feet wide. In 1882 a project was adopted for building a dike to extend out from Sandy Point, with an arm parallel to the channel and 3,200 feet long, in order to contract the channel and maintain 16 feet depth on Fort Hale Bar, when that depth should be obtained by dredging.

Up to July 1, 1892, the shore arm and 2,089 feet of the channel arm of the Sandy Point dike had been built; a 16-foot channel from 400 to 700 feet wide had been made and maintained all the way up the harbor to Tomlinson's Bridge, except over the Fort Hale Bar, where the depth is but 13 feet.

Commerce in this harbor has been much hampered by shoaling and by insufficient width in the upper part, where relief seemed to be more urgently needed than at Fort Hale Bar; therefore, during the past fiscal year dredging was done to widen the channel between Long Wharf and Tomlinson's Bridge, removing the shoals which had formed in the previous channel, making a depth of 16 feet at mean low water.

The increased width was of immediate benefit to vessels going to or from the wharves, or waiting for berth to unload.

Future appropriations will be applied to dredging and, if necessary, to further extension of the dike.

July 1, 1892, balance unexpended	$718.40
Amount appropriated by act approved July 13, 1892	15,000.00
	15,718.40
June 30, 1893, amount expended during fiscal year	15,447.82
July 1, 1893, balance unexpended	270.58
Amount (estimated) required for completion of existing project	48,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	48,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 6.)

7. Breakwaters at New Haven, Conn.—In 1880 a project was adopted for making a harbor of refuge at the entrance of New Haven Harbor by the construction of two riprap breakwaters; the first to be 3,300 feet long, extending northeasterly from the light-house on Southwest Ledge to Quixes Ledge; the second to be 4,200 feet long, extending northwesterly from Luddington Rock. The estimated cost was $1,311,134.

The river and harbor act of August 11, 1888, provided:

And the Chief of Engineers may, if deemed necessary, relocate the western breakwater, and the Secretary of War is authorized, in his discretion, to expend any portion of said sum in commencing its construction.

The New Haven Harbor commissioners proposed a plan for relocation of the western breakwater, which would largely increase the anchorage afforded under the original project, and which would cost about $5,000,000.

There was no doubt of the desirability of increasing the anchorage ground, but the expenditure required by this plan was larger than the present demands of commerce seemed to warrant. A plan was suggested by the officer in charge for changing the location of the western breakwater to the southwest about 6,000 feet, and constructing a breakwater 5,000 feet long, which should start at a point 1,000 feet north 54 degrees east from Luddington Rock, and extend south 54 degrees west, crossing the rock; also for constructing a smaller breakwater from the east shore toward Quixes Ledge, to better protect the harbor from easterly storms, leaving an eastern entrance channel 800 feet wide and 13 feet deep. The cost of these works, in addition to the estimates of $1,311,134, would be about $840,000.

Upon appropriation of $120,000 by the river and harbor act of 1890, the modifications of project above described were adopted. Further details concerning this plan, and a sketch showing location of proposed works, are printed in the Annual Report for 1889, part 1, pp. 60 and 61; also Appendix D 6, pp. 675–685.

Up to July 1, 1892, the East Breakwater, 3,450 feet long, had been completed, affording considerable shelter to the east side of the harbor, and 1,980 linear feet of the Middle Breakwater overlying Luddington Rock had been built to partial height and width. During the past fiscal year the Middle Breakwater has been extended about 931 linear feet, and part has been built up to the required dimensions; under an existing contract it will be further extended to a total length of about 3,400 feet, and the whole work enlarged. At its present length the breakwater affords partial shelter to about one-half the west entrance to the harbor.

Under future appropriations it is proposed to extend the breakwater.

July 1, 1892, balance unexpended		$52,628.91
Amount appropriated by act approved July 13, 1892		120,000.00
		172,628.91
June 30, 1893, amount expended during fiscal year		85,571.73
July 1, 1893, balance unexpended		87,057.18
July 1, 1893, outstanding liabilities	$28,477.96	
July 1, 1893, amount covered by uncompleted contracts	3,214.89	
		81,692.85
July 1, 1893, balance available		5,364.33
Amount (estimated) required for completion of existing project		1,541,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		500,000.00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 7.)

8. *Milford Harbor, Connecticut.*—This harbor consists of a broad, open bay, from the head of which a small tidal stream extends three-quarters of a mile inland to the upper wharf. Originally the depth on

the bar at the mouth of the river was less than 2 feet at mean low water; in parts of the river the channel ran nearly bare.

Under the first project for improvement, adopted in 1872, a channel 4 feet deep and 100 feet wide was excavated through the bar, and thence 40 to 60 feet wide to the upper wharf; small jetties were built to protect the east bank from erosion, and two jetties were built to preserve the channel on the bar, at a total cost of $34,000. In 1881 a project was adopted for making the channel through the bar 8 feet deep at mean low water and 100 feet wide, at an estimated cost of $11,000.

The 8-foot channel has been completed to 100 feet width.

July 1, 1892, the channel over the outer bar was in fair condition; that from the bar to the upper wharves had shoaled somewhat, especially in the upper part. Long Jetty had been repaired as far as seemed necessary, and the project for the improvement was considered completed.

No work was done during the past fiscal year.

July 1, 1892, balance unexpended	$175.46
June 30, 1893, amount expended during fiscal year	175.46

(See Appendix D 8.)

9. Housatonic River, Connecticut.—The navigable part of this river extends from Derby, Conn., to Long Island Sound, a distance of 13 miles, and was originally obstructed by several bars upon which the low-water depth was from 3 to 5 feet.

In 1871 a project was adopted for making and maintaining a channel 100 feet wide and 7 feet deep at mean low water, throughout this distance. Besides the necessary dredging, it contemplated building a breakwater east of the channel over the bar at the river's mouth.

A channel of the required depth has been dredged several times through the worst bars.

July 1, 1892, the available depth in the river channel was about 4½ feet at mean low water, and over the bar, at the mouth, about 6 feet; the breakwater had been built to a length of 4,572 feet.

During the past fiscal year dredging has been done to make a depth of 7 feet on the outer bar, where work is now in progress, and the breakwater has been extended to a total length of 4,740 feet.

Under existing contracts, the channel at the mouth will be completed to 7 feet depth, the breakwater will be further extended to a length of about 5,000 feet; and a small dike will be begun near the mouth of the river, intended to straighten the channel and to reduce the dredging at the bend below Stratford. In order to make the channel permanent over the outer bar, it is necessary to further extend the breakwater, as projected.

July 1, 1892, balance unexpended		$11,044.68
Amount appropriated by act approved July 13, 1892		20,000.00
		31,044.68
June 30, 1893, amount expended during fiscal year		14,588.49
July 1, 1893, balance unexpended		16,456.19
July 1, 1893, outstanding liabilities	$1,648.76	
July 1, 1893, amount covered by uncompleted contracts	12,980.50	
		14,629.26
July 1, 1893, balance available		1,826.93

Amount (estimated) required for completion of existing project	112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 9.)

10. Bridgeport Harbor, Connecticut.—The available depth in this harbor was originally 5 feet at mean low water.

The first project for improvement provided for an 8-foot channel over the outer and inner bars. This was dredged on the outer bar in 1837, and on both bars in 1853. In 1871 a project was adopted for making a channel 12 feet deep and 100 feet wide, subsequently modified to 300 feet, and for building a jetty on the east shore to check the influx of sand.

This was accomplished in 1882, and a new project was adopted for widening to 600 feet the channel from the inner beacon to the Naugatuck Railroad Wharf, to provide for vessels driven in by bad weather, without blocking the main channel. The estimated cost of the latter project was $60,000; it is very nearly completed. A small area remains near the inner beacon, which it is considered desirable to dredge. The project was extended in 1888 to include widening the channel above the railroad wharf in order to relieve the crowding at that point, and was further extended by act of Congress authorizing the expenditure of the appropriation of 1888 towards dredging a 9-foot channel up to the head of the upper harbor above the bridges, and by the river and harbor act of 1890, which directed the beginning of the breakwater from the tongue to the inner beacon. The total estimated cost of these extensions was $65,000, of which $30,000 has been appropriated.

Up to July 1, 1892, a channel 12 feet deep at mean low water existed from Long Island Sound nearly to the lower bridge with widths from 75 to 600 feet; at the lower bridge shoaling had slightly reduced the depth. Above the lower bridge, practically to the head of navigation, the channel was 9 feet deep at mean low water, and from 60 to 90 feet wide. The breakwater from the Tongue to the Inner Beacon had been built its full length, 1,165 feet, but not to the full cross section considered necessary for permanence; it afforded a shelter of value to the anchorage ground out to the lower wharves.

During the past fiscal year the anchorage between the Inner Beacon and the Naugatuck Railroad Wharf was widened by 170 feet, making the width of channel at that point about 770 feet. The location of this work was prescribed by the appropriation act, and being outside the project for improvement does not reduce the cost of completion of the project.

Future appropriations should be applied to extending and widening the channel above the horse railroad bridge, to repairing the harbor channel and widening it above the railroad wharf, and to enlarging the breakwater as projected.

July 1, 1892, balance unexpended	$1,410.15
Amount appropriated by act approved July 13, 1892	20,000.00
	21,410.15
June 30, 1893, amount expended during fiscal year	20,221.78
July 1, 1893, balance unexpended	1,188.37
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 10.)

11. Black Rock Harbor, Connecticut.—This harbor consists of a bay partly sheltered by Fayerweather Island and of two small streams extending inland from the head of the bay. The depth in Cedar Creek,

the more important of these streams, was from 2 to 4 feet at mean low water, and the channel was narrow and very crooked.

The project for improvement submitted in 1883 included dredging a channel 3,300 feet long, 80 feet wide, and 6 feet deep, to extend up Cedar Creek, and a breakwater from Fayerweather Island to the mainland. The estimated cost was $80,000.

Up to July 1, 1892, the breakwater had been built to the full length, but not to the width and height projected. The proposed channel had been dredged to the full extent projected, but had slightly shoaled on the sides. This channel was largely used and was indispensable to the commerce of the upper part of the harbor.

Nothing has been done during the past fiscal year. A contract for dredging is in force, under which the shoal parts of the channel will be deepened and the bends widened.

Future appropriations should be applied to maintaining and extending the channel, and, if necessary, to enlarging the breakwater.

July 1, 1892, balance unexpended	$405.63
Amount appropriated by act approved July 13, 1892	5,000.00
	5,405.63
June 30, 1893, amount expended during fiscal year	435.97
July 1, 1893, balance unexpended	4,969.66
July 1, 1893, amount covered by uncompleted contracts	4,250.00
July 1, 1893, balance available	719.66

Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 11.)

12. Saugatuck River, Connecticut.—This river is a tidal stream, extending inland about 4½ miles by course of channel from Long Island Sound to Westport, Conn. It has a natural depth of 5 feet at mean low water, in a rather narrow, crooked channel, up to the railroad bridge at Saugatuck, about 3 miles from the Sound; thence the depth decreases gradually until at Westport it is less than 1 foot. The channel is somewhat obstructed by rocks in its upper part.

From 1826 to 1838 a short breakwater was built on Cedar Point, the east side of the river's mouth, to prevent sand obstructing the entrance; the work was repaired and extended in 1870. In 1836–1840 a canal was cut through "Great Marsh" to shorten the sailing course to the westward; since 1850 it has been so filled up as to be of little use.

July 1, 1892, the channel depths had not materially changed; the breakwater at Cedar Point was in fair condition, but needed some repair; the canal was only passable to light-draft vessels at high water, being nearly bare at either end at low tide.

Under provisions of the river and harbor act approved September 19, 1890, an examination of Saugatuck River was made, and a project submitted for extending the 4-foot channel 60 feet wide to the village of Westport. An appropriation of $7,000 for the work was made by the river and harbor act of July 13, 1892, and dredging has recently begun. The available funds will more than half complete this work.

Future appropriations will be applied to completing the 4-foot channel as projected.

Amount appropriated by act approved July 13, 1892		$7,000.00
June 30, 1893, amount expended during fiscal year		970.93
July 1, 1893, balance unexpended		6,029.07
July 1, 1893, outstanding liabilities	$765.25	
July 1, 1893, amount covered by uncompleted contracts	4,954.23	
		5,719.48
July 1, 1893, balance available		309.59
Amount (estimated) required for completion of existing project		3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 12.)

13. Norwalk Harbor, Connecticut.—This harbor consists of the tidal part of Norwalk River, extending from Norwalk, Conn., to the river's mouth, a distance of about three miles. South Norwalk is on the west bank of the river, about one and a half miles below Norwalk. Originally the depth up to South Norwalk was about 5 feet at mean low water; between there and Norwalk the river bed ran nearly bare.

The first project for improvement contemplated a channel 100 feet wide and 6 feet deep to Norwalk. In 1881 the project was modified to provide for a depth of 8 feet below South Norwalk. The last estimate upon this work placed the cost from commencement at $84,000.

Some parts of the river have required dredging several times.

July 1, 1892, the channel was 100 feet wide and 8 feet deep up to South Norwalk, and thence to Norwalk 6 feet deep and 60 to 100 feet wide. It was constantly used by the commerce of Norwalk and South Norwalk, to which it was indispensable. The project was at that time reported completed.

During the past fiscal year no work was done, and nothing further is required under the existing project.

July 1, 1892, balance unexpended	$183.53
June 30, 1893, amount expended during the fiscal year	183.53

(See Appendix D 13.)

14. Wilsons Point Harbor, Connecticut.—This harbor is a bay on the north shore of Long Island Sound, sheltered from all storms, except southerly ones. Its natural depth of 16 feet at the mouth shoaled to about 5 feet at low water at the wharves of the New England Terminal Company, a corporation formed to secure water privileges for the Housatonic Railroad system and its connections.

In 1888 $25,000 was appropriated for this improvement as a part of Norwalk Harbor, and a project was adopted for making a channel 300 feet wide and 15 feet deep up to the vicinity of the wharves. The required depth was secured, with width of 400 feet.

In 1890 $30,000 was appropriated for this harbor, and up to July 1, 1891, with a total expenditure of $36,814.21, the channel up to the vicinity of the wharves had been made 15 feet deep at mean low water and 480 feet wide, with an additional width of 200 feet for 750 feet on the east side, near the wharves. This permitted vessels of 15 feet draft to approach the wharves at any ordinary stage of tide.

July 1, 1892, the dredged channels were in good condition, and the project was reported completed.

Nothing was done during the past fiscal year.

No further public improvement at this point is needed and no further appropriation is required.

July 1, 1892, balance unexpended	$8,333.70
July 30, 1893, amount expended during fiscal year	7,010.60
July 1, 1893, balance unexpended	1,323.10

(See Appendix D 14.)

15. Five Mile River Harbor, Connecticut.—This harbor is a small inlet over a mile long, and from 300 to 800 feet wide, on the north shore of Long Island Sound. The natural low-water depth at the mouth is about 3 feet, shoaling to zero half way up the harbor.

The project for improvement proposed in a report on a survey made in 1886, and adopted under an appropriation of $5,000 made August 11, 1888, provides for dredging a channel 8 feet deep at mean low water, 100 feet wide, and about 6,000 feet long, extending to the head of the harbor; the cost was estimated at $25,000.

The total amount appropriated for this improvement is $15,000.

Up to July 1, 1892, $9,886.96 had been expended, and a channel 60 feet wide and 2,450 feet long had been dredged to a depth of 8 feet at mean low water, extending from Long Island Sound to the vicinity of the lower wharves. This channel has been extended to some of the wharves by private work, and is now used for anchorage and for commercial purposes.

Nothing was done during the past fiscal year. A contract for dredging is in force, under which the channel will be extended up the harbor.

Future appropriations will be applied to widening and extending the channel, as projected.

July 1, 1892, balance unexpended	$113.04
Amount appropriated by act approved July 13, 1892	5,000.00
	5,113.04
June 30, 1893, amount expended during fiscal year	84.46
July 1, 1893, balance unexpended	5,028.58
July 1, 1893, amount covered by uncompleted contracts	4,350.00
July 1, 1893, balance available	678.58

Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 15.)

16. Stamford Harbor, Connecticut.—This harbor consists of a bay on the north shore of Long Island Sound, and of two tidal inlets, known as the East and West Branches, extending up to the village of Stamford. The original depth in the West Branch was from 1 to 3 feet, gradually increasing in the bay to a depth of 12 feet; the East Branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet at mean low water.

The project of improvement adopted in 1886 provided for dredging a 5-foot channel 80 feet wide up to the head of the West Branch. This was accomplished in 1892. In that year a project was adopted providing for enlarging the channel of the West Branch to 150 feet width and 7 feet depth, and dredging out the basin between the harbor lines at the head of this branch; also for making the channel of the East Branch 100 feet wide for a length of 8,535 feet, and 50 feet wide for a length of 1,200 feet, with depth of 9 feet, at a total estimated cost of $123,500.

July 1, 1892, nothing had been done under the new project.

During the past fiscal year dredging has been done to widen and deepen the channel of the East Branch and work is now in progress, but not far enough advanced to be of material use.

With the available funds it is proposed to make the East Branch channel 60 feet wide and 9 feet deep at mean low water to or nearly to the head of the harbor.

Future appropriations will be applied to dredging to widen and deepen the channels, as projected.

July 1, 1892, balance unexpended		$60.73
Amount appropriated by act approved July 13, 1892		15,000.00
		15,060.73
June 30, 1893, amount expended during fiscal year		965.79
July 1, 1893, balance unexpended		14,094.94
July 1, 1893, outstanding liabilities	$3,572.30	
July 1, 1893, amount covered by uncompleted contracts	9,755.30	
		13,327.60
July 1, 1893, balance available		767.34
Amount (estimated) required for completion of existing project		108,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 16.)

17. Harbor at Cos Cob and Miamus River, Connecticut.—This harbor is a tidal inlet on the north shore of Long Island Sound, extending inland about 2 miles to the village of Miamus. The low-water channel is rather narrow, bordered by wide mud flats, and has a depth of 12 feet or over at the entrance, decreasing to 5 feet at the railroad bridge, halfway up the inlet, and thence to Miamus, decreasing to 2 feet.

The project for improvement, adopted in 1892, provides for dredging to make a channel 6 feet deep at mean low water, with 150 feet width to the railroad bridge and thence to Miamus 100 feet width, estimated to cost $36,000.

Work under this project was recently begun, and up to the close of the fiscal year, the channel had been made 50 feet wide, or more, up to the railroad bridge, under a contract still in progress. The work is not yet far enough advanced to be a material aid to commerce.

Future appropriations will be applied to extending the dredged channel.

Amount appropriated by act approved July 13, 1892		$7,000.00
June 30, 1893, amount expended during fiscal year		441.44
July 1, 1893, balance unexpended		6,558.56
July 1, 1893, outstanding liabilities,	$3,717.95	
July 1, 1893, amount covered by uncompleted contracts	2,407.05	
		6,125.00
July 1, 1893, balance available		433.56
Amount (estimated) required for completion of existing project		29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 17.)

18. Port Chester Harbor, New York.—This harbor consists of a bay opening into Long Island Sound at the mouth of Byram River, and of the lower part of the river itself, which is navigable for about a mile above its mouth.

The original available depth in the river was not more than a foot at low water, and Salt Rock in the river and Sunken Rock in the bay were considered dangerous obstructions.

The project for improvement, adopted in 1871, provided for the removal of these rocks to 9 and 11 feet depth, respectively, and for the construction of a breakwater at Byram Point, at the mouth of the harbor, the estimated cost being $96,632.

In 1884 the project was extended to provide for dredging a channel 2½ feet deep and from 60 to 100 feet wide from the bay to the vicinity of the village wharves.

In 1888 the project was further modified to omit the removal of Sunken Rock, and to build a breakwater from that rock to Byram Point, which should also serve as a beacon on the rock. A revised estimate, made in 1890, in accordance with the modification, reduced the cost of completion by about $40,000.

Up to July 1, 1892, $36,387.98 had been expended in removing Salt Rock to 9 feet depth, in dredging a channel 2½ feet deep, and from 60 to 100 feet wide to within 150 feet of Port Chester Bridge, with 25 feet width to the bridge, and 585 linear feet of the breakwater from Sunken Rock to Byram Point had been constructed.

The dredging and rock removal have resulted in admitting safely vessels of greater draft than formerly. The partial completion of the breakwater has served to mark Sunken Rock and to shelter a small anchorage area at the mouth of the river.

During the past fiscal year the breakwater has been extended partly to high water on Byram Point, under a contract still in progress.

Future appropriations will be applied to completing the breakwater and to maintaining or enlarging the dredged channel.

July 1, 1892, balance unexpended		$612.02
Amount appropriated by act approved July 13, 1892		5,000.00
		5,612.02
June 30, 1893, amount expended during fiscal year		1,284.78
July 1, 1893, balance unexpended		4,327.24
July 1, 1893, outstanding liabilities	$2,055.85	
July 1, 1893, amount covered by uncompleted contracts	1,878.60	
		3,934.45
July 1, 1893, balance available		392.79
Amount (estimated) required for completion of existing project		15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D 18.)

19. *Larchmont Harbor, New York.*—This is a bay about half a mile wide and extending three-quarters of a mile inland, with depth gradually diminishing from 18 feet at and near the mouth. The mouth of the bay was obstructed by two rocks (Umbrella Rock and Huron Rock), always covered, and owing to its width the harbor anchorage was little protected from easterly and southerly storms.

A survey was ordered by Congress in 1888, and afterwards a project was adopted for connecting Umbrella Rock with the west shore and Huron Rock with the east shore by riprap breakwaters, which would sufficiently mark the rocks and would cover the harbor. The estimated cost of the project was $105,000.

Up to July 1, 1892, $4,879.05 had been expended in constructing 74 linear feet of Umbrella Breakwater and 64 linear feet of Huron Breakwater, the location being over the rocks. The breakwaters serve to mark the rocks, but are not long enough to afford any appreciable shelter.

No work has been done during the past fiscal year.

Future appropriations should be applied to completing the breakwaters.

July 1, 1892, balance unexpended	$120.95
July 1, 1893, balance unexpended	120.95
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 19.)

20. East Chester Creek, New York.—This is a small tidal stream, emptying into Pelham Bay. It was navigable at high tide only, for vessels drawing 7 feet, up to Lockwood, a distance of 2¼ miles. The rise of tide is 7.1 feet.

The project for improvement adopted in 1872, and subsequently modified, provided for a channel 9 feet deep at mean high water, extending to a point 3,000 feet above Lockwood, and terminating at the upper end in a tidal basin. Part of the lower course of the channel was to be protected by dikes, and the whole work was estimated to cost $221,000.

In 1891, this estimate was revised and reduced by omitting the dikes, which seemed unnecessary for maintenance of channels, making the total estimate of cost from beginning $124,000.

Up to July 1, 1892, $69,000 had been appropriated for this improvement, of which $61,858.97 had been expended in dredging and rock removal to make a channel 9 feet deep at high water (2 feet at low water), with width of 125 feet to the head of Goose Island, one-half mile from the mouth of the creek; thence to Town Dock, with width of 100 feet; thence to Lockwood with nearly the same width. Above Town Dock 1,235 linear feet of diking was built to sustain the sides of the channel. The increased depth and straighter courses resulting have been of benefit to the commerce at Town Dock and Lockwood.

During the past fiscal year the channel was extended 1,300 feet above Lockwood by a cut, mainly through Salt Marsh; the depth made was 9 feet at high water and width at bottom 60 feet.

On the west side of this cut the owners of adjacent land have built a dock front, intending to use it for receiving and discharging freights.

Future appropriations should be applied to completing the proposed cut above Lockwood and to repairing and maintaining the previously dredged channels. A revised estimate, submitted with the annual report for 1891, reduced the cost of completing this work to $55,000.

July 1, 1892, balance unexpended	$7,141.03
June 30, 1893, amount expended during fiscal year	7,125.70
July 1, 1893, balance unexpended	15.33
Amount (estimated) required for completion of existing project	55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	55,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 20.)

21. Greenport Harbor, New York.—This harbor, at the eastern end of Long Island, is exposed to easterly storms; its anchorage ground, which was sheltered by Joshua Point, has materially shoaled by the erosion of the point, and by the influx of drifting sand.

The project of improvement, adopted in 1882, provided for the construction of a riprap breakwater extending from Joshua Point 1,700 feet in a southeasterly course, to arrest drifting sand, to check the erosion of the point, and to increase the sheltered area. Its cost was estimated at $46,000.

In 1890 the project was modified to provide for increasing the height of the breakwater from 3 to 5 feet above high water, instead of extending it, and to apply the rest of the estimated amount for completion to dredging and enlarging the anchorage basin.

Up to July 1, 1892, $35,000 had been appropriated for this improvement, and $34,807.09 expended in building the breakwater and increasing the height, and adding, by dredging, about 1½ acres to the area of the sheltered anchorage ground. The effect has been to check the erosion of Joshua Point, to afford complete shelter to the inner part of the harbor, and, in a measure, to make the berths at all the wharves more secure in northeast storms.

During the past fiscal year dredging has been done to increase the area of sheltered anchorage, under a contract still in progress. The completion of this contract will add about 4 acres to the anchorage, and will complete the projected improvement.

No further work is proposed, and no appropriation is required.

July 1, 1892, balance unexpended		$192.91
Amount appropriated by act approved July 13, 1892		11,000.00
		11,192.91
June 30, 1893, amount expended during fiscal year		1,352.43
July 1, 1893, balance unexpended		9,840.48
July 1, 1893, outstanding liabilities	$1,351.18	
July 1, 1893, amount covered by uncompleted contracts	6,919.20	
		8,270.38
July 1, 1893, balance available		1,570.10

(See Appendix D 21.)

22. Port Jefferson Harbor, New York.—This harbor is a large and deep inland bay, with a narrow entrance, or inlet, outside of which was originally a shoal with 3 feet depth at low water. The location of the inlet is one of the most exposed on Long Island Sound.

Under a project adopted in 1871, and modified in 1873 and 1877, an east jetty 1,390 feet long, and a west jetty 940 feet long, were built, both with scant cross section, and a channel 8 feet deep and 100 feet wide was dredged through the bar. The work was completed in 1883, at a total cost of $79,000.

By order of Congress an examination of Port Jefferson Inlet was made in 1888, and subsequently a project was adopted for repairing and enlarging the jetties and dredging to make the channel 10 feet deep and 200 feet wide, at an estimated cost of $90,000.

Under the existing project up to July 1, 1892, $15,867.25 (including outstanding liabilities) had been expended in raising and enlarging part of both jetties, and in beginning dredging between them. The dredging was not sufficiently advanced to realize any material advantage.

During the past fiscal year dredging has been done to widen the channel and a cut has been made through the inlet; this makes an

available depth of 10 feet at mean low tide to the inner harbor. The channel is yet very narrow, the work is in progress, and under the existing contract the width will be made about 150 feet.

Future appropriations will be applied to dredging and to enlarging the jetties.

July 1, 1892, balance unexpended		$10,098.78
Amount appropriated by act approved July 13, 1892		10,000.00
		20,098.78
June 30, 1893, amount expended during fiscal year		1,882.00
July 1, 1893, balance unexpended		18,216.78
July 1, 1893, outstanding liabilities	$4,398.42	
July 1, 1893, amount covered by uncompleted contracts	11,976.58	
		16,375.00
July 1, 1893, balance available		1,841.78
Amount (estimated) required for completion of existing project		55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 22.)

23. Huntington Harbor, New York.—This is a tidal inlet extending southward from Huntington Bay to the village of Huntington. It is about 2 miles long, quite narrow, and landlocked, and has a natural available depth of nearly 8 feet at mean low water, up to within three-fourths of a mile of the head of the harbor, where the low-water depth shoaled gradually to zero.

In 1872-'73 a channel 3 feet deep and 150 feet wide was dredged in the upper part of the harbor by the United States at a cost of $22,500. Within ten years following this had nearly filled up.

In 1884 a survey was ordered by Congress, and subsequently a project for improvement was adopted providing for redredging a channel 8 feet deep and 100 feet wide up to the upper wharves, at an estimated cost of $42,000. The estimate also includes a pile protection for part of the channel, but it seems probable that equally good results can be obtained by applying the funds to dredging a greater width.

July 1, 1892, the channel had been made 8 feet deep at mean low water, and 90 feet wide for a length of 2,900 feet, extending nearly to the upper landings. This channel was generally used by the commerce of the harbor, and delays waiting for high tide were reduced or wholly avoided.

During the past fiscal year the channel has been maintained and widened to 105 feet up to the bend at the steamboat landing, and the width at the bend was made 185 feet.

Future appropriations will be applied to dredging to maintain and further widen and extend this channel.

July 1, 1892, balance unexpended	$409.21
Amount appropriated by act approved July 13, 1892	5,000.00
	5,409.21
June 30, 1893, amount expended during fiscal year	5,011.72
July 1, 1893, balance unexpended	397.49
Amount (estimated) required for completion of existing project	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 23.)

24. Glen Cove Harbor, New York.—This harbor is an inlet on the east side of Hempstead Bay, which is accessible only at high tide, and a breakwater was needed to shelter vessels while at anchor waiting for tides.

The project for improvement, adopted in 1888, provides for a riprap breakwater about 2,500 feet long, extending in a west-southwesterly direction from the northwest corner of the Glen Cove Dock, the top to be 5 feet wide and 3 feet above mean high water, and slopes to be 1 on 1. Its estimated cost was $201,960.

Up to July 1, 1892, 1,056 linear feet of the breakwater had been built to a reduced cross-section, temporarily adopted, in order to secure more shelter with the available funds. The breakwater made it possible for vessels to use the main landing in all weather, and to wait at anchor for tide high enough to enter the inner harbor of Glen Cove.

During the past fiscal year the breakwater has been raised to a height of four feet above high water for nearly its whole length, under a contract still in progress.

Under this contract, the enlargement will be completed and the breakwater farther extended.

Future appropriations will be applied to extending the breakwater, as projected.

July 1, 1892, balance unexpended		$237.37
Amount appropriated by act approved July 13, 1892		10,000.00
		10,237.37
June 30, 1893, amount expended during fiscal year		3,442.32
July 1, 1893, balance unexpended		6,795.05
July 1, 1893, outstanding liabilities	$3,417.17	
July 1, 1893, amount covered by uncompleted contracts	3,277.50	
		6,694.67
July 1, 1893, balance available		100.38
Amount (estimated) required for completion of existing project		156,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix D 24.)

25. Flushing Bay, New York.—Before improvement, the available depth in this broad shallow bay, and in the channel leading up to Flushing, was less than 4 feet at mean low water.

The project for improvement, adopted in 1879, contemplated building 16,700 feet of diking to form a tidal basin, which, by filling and discharging through the main channel, would maintain a channel depth of 6 feet or more at mean low water, after once dredging. The bottom is soft mud. The estimated cost of this work was $173,500.

In 1888 the project was modified to omit part of the diking, which then appeared unnecessary, and in 1891, at the request of many citizens, the extension of dikes was wholly omitted from the project.

Up to July 1, 1892, $104,717.36 had been expended in building 4,663 linear feet of diking, and in dredging and redredging to make and maintain a channel of 6 feet depth at mean low water. The channel is of great use to the commerce of Flushing. It will require annual or frequent dredging to maintain it.

During the past fiscal year 31,378 cubic yards of sand and mud were removed, widening the channel at the bend at the south end of the dike and cutting through a shoal near its north end, and in making a cut

through a middle ground at the head of the harbor where a few bowlders were also removed. The depth was made about 8 feet at mean low water, in order to maintain a depth of 6 feet for at least a year.

It is proposed to apply future appropriations to dredging, to maintain and widen the 6-foot channel.

July 1, 1892, balance unexpended	$282.64
Amount appropriated by act approved July 13, 1892	10,000.00
	10,282.64
June 30, 1893, amount expended during fiscal year	5,263.62
July 1, 1893, balance unexpended	5,019.02
July 1, 1893, outstanding liabilities	4,176.06
July 1, 1893, balance available	842.26
Amount (estimated) required for completion of existing project	58,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 25.)

26. Patchogue River, New York.—This is a shallow tidal inlet, extending about a mile northward from the shore of Great South Bay, Long Island, to the village of Patchogue. The natural depth in the stream and over a bar at the mouth was from 2 to 3 feet at mean low water, and the rise of tide is about 1 foot.

In 1880, and again in 1886, examinations were made by order of Congress, and subsequently a project was adopted for making a channel 6 feet deep at mean low water and 60 feet wide up to the village wharves, to be protected at the mouth by a jetty on the west side, at an estimated cost of $40,000.

Up to July 1, 1892, $15,000 had been appropriated, and $13,818.38 had been expended, building the jetty to a length of 1,340 feet, and making a channel 6 feet deep and 50 feet wide from deep water in Great South Bay into the river. The channel was not far enough extended to be of great use.

During the past fiscal year 20,000 cubic yards of mud was removed, extending the channel 1,426 linear feet, with width of 60 feet and depth of 6 feet or over; a middle ground in the lower harbor was dredged out, connecting the channel with private works, which has the effect of widening the channel to over 150 feet at that point, affording a small anchorage area. The existing channel affords access to the wharves in the lower part of the river, but should be extended to the head of the stream to secure its full usefulness.

Future appropriations will be applied mainly to dredging.

July 1, 1892, balance unexpended	$1,258.99
Amount appropriated by act approved July 13, 1892	8,000.00
	9,258.99
June 30, 1893, amount expended during fiscal year	5,078.82
July 1, 1893, balance unexpended	4,180.17
July 1, 1893, outstanding liabilities	2,798.39
July 1, 1893, balance available	1,381.78
Amount (estimated) required for completion of existing project	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 26.)

27. Browns Creek, Sayville, N. Y.—This is a narrow stream extending northward from Great South Bay to the Sayville highway bridge, above which it is wholly a fresh-water creek. The natural depth in the creek was from 1 to 3 feet at low tide, and on a bar at the mouth it was less than 1 foot.

A survey was made by order of Congress in 1889, and a project was adopted for making the creek 100 feet wide and 4 feet deep at mean low water, the entrance channel to be protected by riprap jetties on either side, at a total estimated cost of $46,000.

The total amount appropriated for this work is $17,000.

July 1, 1892, the west jetty had been built to a length of 492 feet, and the east jetty partly completed to a length of 450 feet. A channel 100 feet wide and 4 feet deep at mean low water had been dredged 1,450 feet long, extending into the marsh along the stream, which was freely used by small vessels for anchorage during night or storms.

During the past fiscal year the east jetty was completed to a length of 438 feet, removing part of the stone at the outer end to finish the rest of the work; shoals were removed from the dredged channel, which was also extended 443 feet farther up.

Prior to 1891 this creek was of no value for purposes of navigation. It is now quite extensively used by boats engaged in oystering, etc.

Future appropriations will be applied to maintaining and extending the dredged channel, and to such repairs and extension of the jetties as become necessary.

July 1, 1892, balance unexpended	$1,471.40
Amount appropriated by act approved July 13, 1892	5,000.00
	6,471.40
June 30, 1893, amount expended during fiscal year	6,095.57
July 1, 1893, balance unexpended	375.83
Amount (estimated) required for completion of existing project	29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D 27.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Col. D. C. Houston, Corps of Engineers, and reports thereon submitted.

1. Westport Harbor, Connecticut.—Col. Houston submitted report of examination under date of November 1, 1892. It is his opinion, concurred in by this office, that the locality is worthy of improvement by the United States. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 114, Fifty-second Congress, second session. (See also Appendix D 28.)

2. Norwalk Harbor, Connecticut.—Col. Houston submitted report of examination under date of November 3, 1892. It his opinion, concurred in by this office, that the locality is worthy of improvement by the General Government. The cost of a survey necessary for preparation of project and estimate of cost of improvements is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 82, Fifty-second Congress, second session. (See also Appendix D 29.)

3. Berrians Creek, Long Island, New York.—Col. Houston submitted report of examination under date of November 1, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 80, Fifty-second Congress, second session. (See also Appendix D 30.)

4. Southold Harbor, Long Island, New York.—Col. Houston submitted report of examination under date of November 2, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 48, Fifty-second Congress, second session. (See also Appendix D 31.)

IMPROVEMENT OF HUDSON RIVER AND NEW YORK HARBOR AND OF RIVERS AND HARBORS IN THEIR VICINITY, NEW YORK AND NEW JERSEY.

This district was in the charge of Lieut. Col. G. L. Gillespie, Corps of Engineers, with Lieut. James G. Warren, Corps of Engineers, under his immediate orders.

1. Hudson River, New York.—The improvement of this river has been restricted, by the wording of the appropriation acts, to that part of it lying between Troy, at the head of navigation, 6 miles above Albany, and New Baltimore, about 14 miles below Albany.

Before the improvement was begun the navigable depth in the channel between New Baltimore and Albany was 7½ feet at mean low water; between Albany and Troy, 4 feet.

The mean range of tides at State Dam at Troy is 0.80 feet; at Albany, 2.32 feet; and at New Baltimore, 3.42 feet.

The plan of improvement adopted in 1867 proposed making the navigable depth between New Baltimore and Albany 11 feet, and between Albany and Troy 9 feet. This was to be accomplished by the construction of longitudinal dikes to direct the currents and by dredging.

The estimated cost of making this improvement, prepared in 1882, subject to be increased, was $1,078,304. In 1889 the estimated cost was $1,424,435.

The amount expended to June 30, 1892, inclusive of outstanding liabilities, was $1,247,940.29, of which sum a large part has, however, from the necessities of the case, been applied partly to the repair of decaying dikes and partly to dredging. At that date the dikes provided for in the project of improvement, so far as built, had resulted in securing a channel depth of 10 feet nearly all the way from New Baltimore to Albany, and of 8 feet nearly all the way from Albany to Troy.

The river and harbor act of July 13, 1892, sanctioned the new project submitted in 1891, which provided for maintaining old improvements, and constructing new regulating works along 8 additional miles of the river below New Baltimore, and also for deepening the entire reach of the river under improvement, so as to afford a channel 400 feet wide and 12 feet deep, at mean low water, from Coxsackie to the foot of Broadway, Troy, N. Y., and thence 300 feet wide and 12 feet deep to the State Dam. The estimated cost of the project is $2,500,000.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $65,448.22, and was applied under the old project; to the repairs of the dikes; to the construction of new dikes; to the removal of Overslaugh Rock above Van Wies Point;

to the partial removal of rock at Breaker Island, near Troy, and to the removal of wreck from navigable channel under improvement. Under the new project contract was entered into with P. Sanford Ross, December 19, 1892, for the removal of all the rock and sand covering rock in place, and with Edwards, Howlett, and Thompson, December 23, 1892, for all the dike-work and dredging required for the improvement. Under these contracts the work of repairs to existing dikes, construction of new dikes, dredging at Mulls Cross-over and Austins Rock, and removal of Austins Rock is in progress at the close of the fiscal year.

July 1, 1892, balance unexpended		$41,113.73
Amount appropriated by act approved July 13, 1892		187,500.00
Amount appropriated by sundry civil act approved March 3, 1893		500,000.00
		728,613.73
June 30, 1893, amount expended during fiscal year		54,411.13
July 1, 1893, balance unexpended		674,202.60
July 1, 1893, outstanding liabilities	$11,037.09	
July 1, 1893, amount covered by uncompleted contracts	620,736.13	
		631,773.22
July 1, 1893, balance available		42,429.38

Amount (estimated) required for completion of existing project	1,760,406.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 1.)

2. Harbor at Saugerties, N. Y.—This harbor is formed by the mouth of Esopus Creek, which empties into the Hudson River on the west bank about 100 miles above New York City.

The bar at the entrance at the time of the original examination, made in November, 1883, with the view of preparing estimates for improvement, had a navigable depth of 3 feet only at mean low water, and the distance between the 6-foot curves across it was 1,100 feet. The harbor could therefore be entered only at high water even by the smallest class of vessels. The range of tides is 4 feet, approximately.

The plan of improvement which was adopted in 1887 provided for securing a depth of 8 feet, mean low water, from the entrance to the head of navigation, 1¾ miles, by the construction of two parallel dikes, each 2,300 feet long, 260 feet apart on the inside and 280 feet apart on the outside, and by dredging, if found necessary, 30,000 cubic yards of material from the channel between the dikes.

The estimated cost of the improvement was $52,000; the amount expended upon the project up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $41,407.06. At that date both dikes had been completed; the north dike had then a length of 2,058 feet and the south dike a length of 2,363 feet and the waterway between them was 260 feet wide, and the navigable channel had been deepened by dredging for a width of 150 feet between 9-foot curves.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $2,930.95, and was applied in repairing the timber work of the south dike and refilling of both dikes with stone where settlement had taken place, and in removing, by hired labor, by use of the drill scow *Hudson*, several bowlders from the channel near the shore end of the jetties and removing the rocky reef at Barclays Point.

The existing channel from the entrance to the head of navigation is 150 feet to 300 feet wide and 9 feet deep at mean low water.

July 1, 1892, balance unexpended	$592.94
Amount appropriated by act approved July 13, 1892	5,000.00
	5,592.94
June 30, 1893, amount expended during fiscal year	2,775.72
July 1, 1893, balance unexpended	2,817.22
July 1, 1893, outstanding liabilities	155.23
July 1, 1893, balance available	2,661.99
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 2.)

3. Harbor at Rondout, N. Y.—This harbor is formed by the mouth of Rondout Creek, which empties into the Hudson River on its west side about 90 miles above the city of New York, and is the eastern terminus of the Delaware and Hudson Canal. The creek is a tidal stream for 3 miles above its mouth, and prior to 1871 all improvements had been made by private parties. The range of tides is 4 feet, approximately.

The Government made a survey of the harbor in 1869, and the available depth of water then in the channel was 7 feet at mean low water. The project of improvement, based on this survey, was for the formation and maintenance of a channel 100 feet wide and 14 feet deep, mean low water, at the mouth of the creek, to be obtained by means of dikes and dredging. The parallel channel dikes, 350 feet apart at the entrance, were to be built outward into the Hudson River, and a branch dike upstream, starting at outer end of north pier, to protect the north dike against destruction by ice.

The estimated cost of the project was $172,500.

The project was completed in 1880 at an actual cost of $90,000 only. At that time the length of the north dike was 2,200 feet, and that of the south dike 2,800 feet, and there was a channel between them 50 feet wide and 13½ feet deep, mean low water, and 100 feet wide and 12 feet deep, mean low water.

The appropriations which have been made since 1880 have been applied exclusively to the repair of the dikes.

The amount expended upon the project and upon repairs up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $106,500, at which date the navigable channel was 100 feet wide and from 12½ to 13½ feet deep, mean low water. The dikes were built originally of timber and stone to the height of mean high water, but the timber has since become so damaged by age and by the ice that the stone filling in many places has fallen out from between the rows of piles and the height of the dikes has been correspondingly lowered.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $2,927.67, and was applied in repairing the north branch and south dikes, by replacing worn and decayed timber and refilling with stone. The repairs were still in progress at the close of the fiscal year.

The improvement is in fair condition, but annual repairs to the dikes will be required.

Amount appropriated by act approved July 13, 1892		$5,000.00
June 30, 1893, amount expended during fiscal year		1,743.11
July 1, 1893, balance unexpended		3,256.89
July 1, 1893, outstanding liabilities	$1,185.56	
July 1, 1893, amount covered by uncompleted contracts	559.80	
		1,745.36
July 1, 1893, balance available		1,511,53
Amount (estimated) required for completion of existing project		15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix E 3.)

4. Wappinger Creek, New York.—Wappinger Creek is a small stream which empties into the Hudson River on the left bank one-half mile below the village of New Hamburg, N. Y. The navigable portion, extending from the mouth to Wappinger Falls, is 2 miles long, approximately, and before improvement afforded navigation to small boats drawing not exceeding 6 feet in waterway which had a width varying from 25 feet to 75 feet. The range of tides at entrance is 4 feet, approximately.

The project for its improvement contained in the report upon the survey November 11, 1889, to comply with the river and harbor act of August 11, 1888, contemplates a channel 80 feet wide and 8 feet deep from the mouth to the falls. The estimated cost of the improvement was $13,000. The amount appropriated by the river and harbor act of September 19, 1890, was $13,000.

The amount expended up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $12,837.15. At that date the channel was 80 feet wide and 8 feet deep, mean low water, from the mouth to the falls.

No funds were expended upon this improvement during the past fiscal year.

The approved project for the improvement was completed April 30, 1892.

July 1, 1892, balance unexpended	$162.85
July 1, 1893, balance unexpended	162.85

(See Appendix E 4.)

5. Harlem River, New York.—The Harlem River and Spuyten Duyvil Creek are both included in this improvement.

Originally there was no navigable waterway between the two streams, as the bed of the connecting reach at Kingsbridge was a long reef of solid rock, bare at low water. The head of navigation at low tide in the Harlem River was practically at High Bridge, 5 miles from its junction with the East River at Hell Gate, for vessels of 7 feet draft, and, at high tide, in Spuyten Duyvil Creek, near Kingsbridge, 1¾ miles from the Hudson, for vessels of 8 feet draft.

The object of the improvement is to form a navigable channel between the East and Hudson rivers.

The project for the improvement as originally adopted in 1875 was for a channel 350 feet wide and 15 feet deep at mean low water. In 1879 the project was so far modified as to increase the width of the channel in the Harlem River and Spuyten Duyvil Creek to 400 feet, retaining the original width of 350 feet through Dyckman Meadow, but increasing the depth there to 18 feet, mean low water. This project

of sea walls and dikes upon others that lay near the edge of the channel. The estimated cost of the project, revised in 1870, was $4,689,820.

Besides the before-mentioned submerged rocks were known to exist at other points in the channel, such as Diamond Reef, [illegible] water, off the Battery; Coenties Reef, 14.3 feet, mean low water, off Coenties Slip; Shell Reef, 9 feet, mean low water, between Eighth and Tenth streets; Ferry Reef, 7 feet, mean low water, and Charlotte Rock, 14½ feet, mean low water, opposite Thirty-fourth street; the Middle Ground, 16 feet, mean low water, off Sunken Meadow, at the entrance to Little Hell Gate, and Mid-Channel Reef, 16½ feet, mean low water, at Barretto Point, opposite Rikers Island.

The project was enlarged in 1874, and the total cost estimated at $5,134,120. Annual Report Chief of Engineers, 1874, Part II, page 164. Besides the improvements already projected at Hell Gate, the new project provided for the construction of a riprap dike to connect the Mill Rocks, sea-walls upon Hog Back and Holmes Rock, and the removal to a depth of 26 feet, mean low water, of Diamond Reef, Coenties Reef, and the small rocks known as Scaly Rock, Blackwells Rock, and the rock off Woolsey's bath house.

The project was enlarged in 1884 to provide for the removal of Pilgrim Rock, opposite Nineteenth Street, to 24 feet, mean low water; in 1889 for the removal of reef off Diamond Reef to 26 feet, mean low water, and Ferry Reef and Charlotte Rock, opposite Thirty-fourth Street, to 26 feet, mean low water; in 1890 for the removal of Shell Reef and reef off Sunken Meadows, to 18 feet, mean low water; and in 1892 for the removal of Baretto Reef to 24 feet, mean low water.

The amount expended up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $4,057,329.98. At that date Hallets Point, covering 3 acres, Way Reef, Shell Drake, Diamond Reef, North Brother Island Reef, Coenties Reef, reef off Diamond Reef, and Scaly Rock had been removed to the depth contemplated in the project. Pilgrim Rock had been reduced to a least depth of 24 feet; Heel Tap had been broken to 26 feet and dredged to 20.5 feet, and the least depths on Frying Pan and Pot Rock were 18 feet, and 22.8 feet at mean low water, respectively; Ferry Reef, off Thirty-fourth Street, had been lowered from a least depth of 7.1 feet to a least depth of 22 feet; Flood Rock and connecting reefs, covering 9 acres, had been broken to 30 feet, and 177,376 tons of débris had been removed; the Negro Heads and Hen and Chickens had been reduced to 18 feet, mean low water, and a new 18-foot channel, 500 feet wide, had been opened across the reef. A sea wall had been built by the Government to connect Great and Little Mill rocks, and another by the city authorities on Bread and Cheese. Under contract 56,239 cubic yards of material and 3,168 tons of bowlders had been removed from Shell Reef off Ninth Street. These results have been of the greatest value to navigation.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $157,708.20, and was applied in removing, by hired labor, 21,126 tons of broken stone from Flood Rock by the use of the two United States engineer dredges; in removing 668 tons of rock by use of the United States steam drilling scow from Ferry Reef, off Thirty-fourth Street, completing its removal to 24 feet, mean low water; in removing 1,382 tons of rock by use of the United States steam drilling scow and United States engineer dredges from reef off Baretto Point, completing its removal to 24 feet, mean low water; in removing 704 tons of broken stone by use of United St[illegible] drilling

harbor act of July 13, 1892. All the necessary data furnished by the survey had been properly studied, but before a project could be prepared to be submitted for the approval of the Chief of Engineers, the cofferdams inclosing the working pits of the contractor were breached, as hereinbefore stated, during a severe storm on the night of April 21, 1893, which caused the suspension of all work. The contracts expired June 1, 1893, but the work contemplated by them had not been entirely completed.

When matters connected with the settlement of these contracts have been adjusted, the work to be done under the available balance will be advertised according to law, and new contracts made.

July 1, 1892, balance unexpended	$190,137.29
Amount appropriated by act approved July 13, 1892	175,000.00
	365,137.29
June 30, 1893, amount expended during fiscal year	186,313.21
July 1, 1893, balance unexpended	1 78,824.08
July 1, 1893, outstanding liabilities	11,098.18
July 1, 1893, balance available	167,725.90
Amount (estimated) required for completion of existing project	1,805,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 5.)

6. East River and Hell Gate, New York.—Originally the channel of East River contained many dangerous rocky obstructions to navigation, lying both above and below mean low water. Especially was this the case at Hell Gate, where the bounding beaches had irregular and shoal rocky foreshores, and the inclosed waterway had a few detached rocky isles with crests rising several feet above high-water mark.

At Hell Gate the channel turns at right angles around Hallets Point, Astoria, and the current runs with a velocity varying at different stages of the tide from 3 to 10 miles an hour over or around Way Reef, Pot Rock, Shell Drake, Frying Pan, Hallets Point, Negro Point, Holmes Rock, Hog Back, Heel Tap, Flood Rock, Hen and Chickens, Gridiron, Mill Rocks, The Negro Heads, Rhinelander Reef, and Bread and Cheese.

Hallets Point projected from the shore at Astoria under water 325 feet to the 26-foot contour, mean low water, and embraced an area of 3 acres.

The detached rocks in the inclosed waterway had varying depths over them. The Middle Reef, with an area of about 9 acres, lay in the middle of the channels of Hell Gate. It had a small backbone, projecting above high water, called Flood Rock, upon which vessels were frequently stranded at ebb tide, when the currents swept directly over the rock. To the northward, near the mouth of the Harlem River, lay the two Mill Rocks, both of which were usually visible at high water. To the eastward, Frying Pan had only 11 feet, mean low water; Heel Tap, 12 feet; Pot Rock, 20 feet, and North Brother Island Reef, 16 feet.

The project of improvement adopted in 1867 provided for the removal to the depth of 26 feet, mean low water, of the rocks and reefs that lay directly in the channel at Hell Gate, and for the construction

of sea walls and dikes upon others that lay near the edge of the channel. The estimated cost of the project, revised in 1870, was $4,689,820.

Besides the obstructions before enumerated submerged rocks were known to exist at other points in the channel, such as Diamond Reef, 16½ feet, mean low water, off the Battery; Coenties Reef, 14.3 feet, mean low water, off Coenties Slip; Shell Reef, 9 feet, mean low water, between Eighth and Tenth streets; Ferry Reef, 7 feet, mean low water, and Charlotte Rock, 14½ feet, mean low water, opposite Thirty-fourth street; the Middle Ground, 11½ feet, mean low water, off Sunken Meadow, at the entrance to Little Hell Gate, and Mid-Channel Reef, 16½ feet, mean low water, at Baretto Point, opposite Rikers Island.

The project was enlarged in 1874, and the total cost estimated at $5,139,120 (Annual Report, Chief of Engineers, 1874, Part II, page 164). Besides the improvements already projected at Hell Gate, the new project provided for the construction of a riprap dike to connect the Mill Rocks, sea-walls upon Hog Back and Holmes Rock, and the removal to a depth of 26 feet, mean low water, of Diamond Reef, Coenties Reef, and the small rocks known as Scaly Rock, Blackwells Rock, and the rock off Woolsey's bath house.

The project was enlarged in 1884 to provide for the removal of Pilgrim Rock, opposite Nineteenth Street, to 24 feet, mean low water; in 1889 for the removal of reef off Diamond Reef to 26 feet, mean low water, and Ferry Reef and Charlotte Rock, opposite Thirty-fourth Street, to 26 feet, mean low water; in 1890 for the removal of Shell Reef and reef off Sunken Meadows, to 18 feet, mean low water; and in 1892 for the removal of Baretto Reef to 24 feet, mean low water.

The amount expended up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $4,057,329.98. At that date Hallets Point, covering 3 acres, Way Reef, Shell Drake, Diamond Reef, North Brother Island Reef, Coenties Reef, reef off Diamond Reef, and Scaly Rock had been removed to the depth contemplated in the project. Pilgrim Rock had been reduced to a least depth of 24 feet; Heel Tap had been broken to 26 feet and dredged to 20.5 feet, and the least depths on Frying Pan and Pot Rock were 18 feet, and 22.8 feet at mean low water, respectively; Ferry Reef, off Thirty-fourth Street, had been lowered from a least depth of 7.1 feet to a least depth of 22 feet; Flood Rock and connecting reefs, covering 9 acres, had been broken to 30 feet, and 177,376 tons of débris had been removed; the Negro Heads and Hen and Chickens had been reduced to 18 feet, mean low water, and a new 18-foot channel, 500 feet wide, had been opened across the reef. A sea wall had been built by the Government to connect Great and Little Mill rocks, and another by the city authorities on Bread and Cheese. Under contract 56,239 cubic yards of material and 3,468 tons of bowlders had been removed from Shell Reef off Ninth Street. These results have been of the greatest value to navigation.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $157,708.20, and was applied in removing, by hired labor, 21,126 tons of broken stone from Flood Rock by the use of the two United States engineer dredges; in removing 668 tons of rock by use of the United States steam drilling scow from Ferry Reef, off Thirty-fourth Street, completing its removal to 24 feet, mean low water; in removing 1,382 tons of rock by use of the United States steam drilling scow and United States engineer dredges from reef off Baretto Point, completing its removal to 24 feet, mean low water; in removing 764 tons of broken stone by use of United States steam drilling scow

and United States engineer dredge *Hell Gate* from reef off Sunken Meadow; and in removing under contract 48,853 cubic yards of fine material and 313 tons of bowlders from Shell Reef, off Ninth Street, completing the contract.

July 1, 1892, balance unexpended	$65,926.41
Amount appropriated by act approved July 13, 1892	150,000.00
	215,926.41
June 30, 1893, amount expended during fiscal year	151,370.93
July 1, 1893, balance unexpended	64,555.48
July 1, 1893, outstanding liabilities	6,337.27
July 1, 1893, balance available	58,218.21
Amount (estimated) for completion of existing project	888,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 6.)

7. Newtown Creek, New York.—This is a tidal stream, about 4 miles long, running through the eastern part of Brooklyn and emptying into the East River opposite Thirty-fourth Street, New York City.

It had formerly a depth of 12½ feet, mean low water, at the mouth, gradually decreasing to 4 feet at the head.

The original project for improvement, adopted in 1880, but modified in 1883, provided for a channel 200 feet wide and 21 to 22 feet deep, mean low water, extending from the mouth up to Vernon Avenue Bridge, and from that point up to the head of navigation on both branches, a channel decreasing from 175 feet to 100 feet in width, and from 18 feet to 10 feet in depth, at an estimated cost of $255,569.

The amount expended up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $141,448.14. At that date the channel from the entrance to Vernon Avenue Bridge was 175 feet wide and 18 feet deep, mean low water; from Vernon Avenue Bridge to Central Oil Works, 80 feet wide and 16 feet deep; from Central Oil Works to Queens County Oil Works, 50 feet wide and 14 feet deep; and from Queens County Oil Works to Penny Bridge, 50 feet wide and 10 feet deep. The channel from Maspeth Avenue to Metropolitan Avenue, east branch, was 100 feet wide and 9 feet deep, mean low water. In the English Kills Branch the channel was 100 feet wide and 8 feet deep from Nichols Chemical Works to a point 700 feet to the eastward.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $36,051.86, and was applied in dredging 91,981 cubic yards of material from various reaches of the creek. At the close of the year the channel from the entrance to Vernon Avenue Bridge was 175 feet wide and 18 feet deep, mean low water; from Vernon Avenue Bridge to Central Oil Works, 80 feet wide and 16 feet deep; from Central Oil Works to Queens County Oil Works, 100 feet wide and 14 feet deep; from Queens County Oil Works to Nichols Chemical Works, 75 feet wide and 10 feet deep; from Nichols Chemical Works to Maspeth Avenue, 50 feet wide and 10 feet deep; from Maspeth Avenue to Metropolitan Avenue, east branch, 100 feet wide and 9 feet deep, and on west branch, 50 feet wide and 10 feet deep. In the English Kills Branch the channel is 100 feet wide and 8 feet

deep, mean low water, from Nichols Chemical Works to a point 700 feet to the eastward.

The cause of the habitual shoalings immediately following dredging is the absence of bulkheads to confine the banks.

The existing channel is not adequate in width or depth to the demands of commerce, and the adopted project for improvement should be completed as early as practicable by methods which will carry the improvement progressively from the mouth to the head of navigation.

July 1, 1892, balance unexpended	$1,051.86
Amount appropriated by act approved July 13, 1892	35,000.00
	36,051.86
June 30, 1893, amount expended during fiscal year	36,051.86
Amount (estimated) required for completion of existing project	78,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	78,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 7.)

8. Buttermilk Channel, New York Harbor.—Buttermilk Channel lies between the city of Brooklyn, N. Y., and Governors Island, New York Harbor, and was formerly obstructed by three shoals.

(1) A shoal lying above and northeast of Governors Island, projecting into Buttermilk Channel and extending over to the main channel on the other side, which originally had a least depth over it of 9½ feet at mean low water.

(2) A shoal putting out from Red Hook Point, on the Brooklyn side, and extending up the eastern side of the channel to the entrance of the Atlantic Basin, with a least depth over it of about 6 feet at mean low water.

(3) A shoal putting out from the southern side of Governors Island and extending toward Red Hook Point Shoal, which is partly dry at mean low water.

The original project of improvement, adopted in 1880, provided for the removal to a depth of 26 feet, mean low water, of such parts of the first-mentioned shoal as came within 850 feet of the Brooklyn wharves. It embraced the crest of the shoal and gave elsewhere to the north and west a depth of not less than 15 feet, mean low water.

The estimated cost of the improvement was $210,000. In view of the increasing importance of the wharves on the Brooklyn shores and the difficulty experienced by deep-draft vessels in getting up to them by reason of this shoal, the project of improvement was modified in 1885 so as to provide for the removal of the entire shoal to a depth of 26 feet, mean low water, at an estimated additional cost of $150,000, making the total estimated cost of the project $360,000.

The river and harbor act of September 19, 1890, made provision for the survey of Red Hook Shoal, lying at the southern entrance to the Buttermilk Channel, and the estimated cost of the removal of this shoal to a depth of 26 feet at mean low water was $529,000.

The amount expended to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $321,506.75, and was applied in dredging the shoal lying above Governors Island. The shoal had been entirely removed to a depth of 26 feet, mean low water.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $12,821.24, and was applied in dredging 32,308 cubic yards of material from Red Hook Shoal.

July 1, 1892, balance unexpended		$24,843.25
Amount appropriated by act approved July 13, 1892		100,000.00
		124,843.25
June 30, 1893, amount expended during fiscal year		6,489.44
July 1, 1893, balance unexpended		118,353.81
July 1, 1893, outstanding liabilities	$6,331.80	
July 1, 1893, amount covered by uncompleted contracts	100,615.28	
		106,947.08
July 1, 1893, balance available		11,406.73

Amount (estimated) required for completion of existing project 404,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix E 8.)

9. Gowanus Bay, New York—Red Hook, Gowanus Creek and Bay Ridge channels.—Gowanus Bay is a part of New York Harbor, lying at the mouth of Gowanus Creek, in the southwestern part of the city of Brooklyn.

The depth of water in the channel of Gowanus Creek and Bay was originally only from 7 to 12 feet at mean low water, which was wholly insufficient for the passage of vessels employed in the commerce of the district.

The plan of improvement, adopted in 1881, provided for a depth of 18 feet to the channels in the bay leading up to the mouth of the creek on both the north and south sides, and for carrying the improvement with the same depth up the creek to Hamilton Avenue Bridge, a distance of 1 mile.

The channel widths were to be 200 feet, except for the last few hundred feet up to the bridge, in which distance the width would gradually decrease.

The estimated cost of this improvement was $192,564.90.

The project for 1881 was modified in 1888 by increasing the depth to 21 feet and the width to 400 feet, while to facilitate the handling of vessels in the contracted space near the mouth of Gowanus Creek more room was provided for by cutting away the angle on the south side at an estimated total cost of $600,000.

The amount expended on the *Red Hook and Gowanus Creek channels* up to June 30, 1892, inclusive of outstanding liabilities, was $30,081.25. At that date this channel, from the entrance to Erie Basin to Twenty-eighth street, was 230 feet wide and 21 feet deep, mean low water, and thence to the foot of Twenty-third street 150 feet wide and 21 feet deep, mean low water.

The improvement of *Bay Ridge channel*, extending from Twenty-eighth street south and west to Sixtieth street, south shore, which, under the project of 1881 was suspended in 1884, was resumed in May, 1891, under a specific appropriation of $100,000 contained in the river and harbor act of September 19, 1890, which provided for a channel 400 feet wide and 21 feet deep. Up to June 30, 1892, the sum of $95,833.35, inclusive of outstanding liabilities, had been expended under contract. At that date this channel was 120 feet wide and 21 feet deep, mean low water, from Twenty-eighth street south to Thirty-ninth street, thence 90 feet wide and 21 feet deep to Sixtieth street, opposite Bay Ridge.

The amount expended during the fiscal year ending June 30, 1893, on the Red Hook and Gowanus Creek channels, inclusive of outstanding liabilities, was $2,405.40, and was applied in removing

13,331 cubic yards of material under contract. At that date this channel from the entrance to Erie Basin to Twenty-eighth street was 255 feet wide and 21 feet deep, mean low water, and thence to the foot of Twenty-third street 150 feet wide and 21 feet deep, mean low water.

The amount expended on the Bay Ridge Channel during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $29,363.06, and was applied in removing 6,996 cubic yards of material under contract. At that date this channel was 140 feet wide and 21 feet deep, mean low water, from Twenty-eighth street south to Thirty-third street, thence 120 feet wide and 21 feet deep to Thirty-ninth street, and thence 90 feet wide and 21 feet deep to Sixtieth street, opposite Bay Ridge.

The beds of both channels have been lowered from 5 to 15 feet, and as the material removed has been sand, the banks, having no confining bulkheads, have correspondingly increased their slopes, the unstable material sliding into the channels and reducing their depths.

The channels also suffer from deposits carried down from Gowanus Canal, and from deposits brought in from outlying shoals by the waves.

These sources of degradation will be appreciably exhausted only when permanent bulkheads are built along both shores to hold the soft and unstable banks.

July 1, 1892, balance unexpended		$29,179.57
Amount appropriated by act approved July 13, 1892		198,600.00
		227,779.57
June 30, 1893, amount expended during fiscal year		28,983.66
July 1, 1893, balance unexpended		198,795.91
July 1, 1893, outstanding liabilities	$2,784.80	
July 1, 1893, amount covered by uncompleted contracts	173,260.20	
		176,045.00
July 1, 1893, balance available		22,750.91

Amount (estimated) required for completion of existing project	281,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E 9.)

10. New York Harbor, New York.—Before the improvement of the main entrance into New York Harbor was undertaken by the United States, the least depth in midchannel on the bar was 23.7 feet at mean low water, and the same was the limiting depth across three other shoals between the bar and deep water in harbor.

A large proportion of the vast commerce of the port which is carried on in vessels of great draft could only cross these shoals at or near high water.

The project for the improvement of Gedney Channel was approved by the Secretary of War in December, 1884, and its extension to cover the whole of the main entrance to the harbor received his approval December 27, 1886. It provides for dredging a channel 1,000 feet wide and 30 feet deep at mean low water, from deep water below the Narrows through the main ship channel and Gedney Channel to deep water outside the bar; maintaining this channel, should it be necessary, either by periodical dredging or by contracting the entrance by the construction of a dike running across the shoals from the Coney Island side, with suitable protection for the head of Sandy Hook to prevent its being scoured away by the increased current.

The estimated cost of obtaining the dredged channel was $1,490,000 for dredging 4,300,000 cubic yards, and the entire cost of the improvement should the construction works prove to be necessary was estimated at between $5,000,000 and $6,000,000.

Under this project an extended survey of the lower bay was made, on which the method of improvement was based.

The total amount expended to June 30, 1892, inclusive of outstanding liabilities, was $1,465,259.38.

At that time the approved project for this work, by dredging, had been completed and a depth of 30 feet, mean low water, for a channel width of 1,000 feet, had been secured from deep water below the Narrows to deep water beyond the bar.

The riprap sea wall authorized by the Chief of Engineers February 20, 1890, for the protection of the north shore of Sandy Hook was built from Jetty No. 1, westward to a point 119 feet westward of Jetty No. 11, a total distance of 2,575 feet.

Baxter Ledge, a narrow ledge of rock lying in the entrance to Kill Van Kull from Upper New York Bay, northeast from St. George Staten Island, and having over it originally a least depth of 18 feet, mean low water, had been removed to a depth of 25.5 feet, mean low water.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $116,371.72, and was applied to the purchase, under contract, of the hydraulic dredging steamer *Reliance* (now named *Gedney*), formerly employed on this work, to operating the steamer by hired labor and to connecting the wharves at Fort Hamilton and Fort Wadsworth with the main ship channel by dredging channels 100 feet wide and 10 feet deep.

July 1, 1892, balance unexpended	$26,544.35
Amount appropriated by act approved July 13, 1892	170,000.00
	196,544.35
June 30, 1893, amount expended during fiscal year	107,836.58
July 1, 1893, balance unexpended	88,707.77
July 1, 1893, outstanding liabilities	8,535.14
July 1, 1893, balance available	80,172.63
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

(See Appendix E 10.)

11. Jamaica Bay, New York.—Jamaica Bay is a tidal bay, situated on the south side of Long Island, near the western end, whose waters flow into the Atlantic Ocean through Rockaway Inlet.

Inside the entrance there is a deep-water basin, from which one navigable channel leads to the northward in the direction of Canarsie, and another, called Beach Channel, to the eastward, behind Rockaway Beach, in the direction of Far Rockaway. From the eastern terminus of one of the branches of the latter channel, which passes through Conch Hole, an artificial cut into Far Rockaway Bay was made several years ago by citizens to enable small boats to pass eastward through that bay into Hempstead Bay and beyond.

The project for this improvement, contained in the report upon the survey October 29, 1891, to comply with the river and harbor act of September 19, 1890, and sanctioned by river and harbor act of July 13, 1892, contemplates a channel 60 feet wide and 5 feet deep, mean low water, from entrance to Bass Channel to foot of Bayswater avenue, Far Rockaway.

The estimated cost of the project was $9,460. The full amount of this estimate was appropriated by the river and harbor act approved July 13, 1892.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $3,727.61, and was applied in dredging 13,845 cubic yards of material from the channel under contract; 2,200 feet of the channel had been dredged to the full projected width of 60 feet and depth of 5 feet, mean low water.

Amount appropriated by act approved July 13, 1892		$9,460.00
June 30, 1893, amount expended during fiscal year		1,368.15
July 1, 1893, balance unexpended		8,091.85
July 1, 1893, outstanding liabilities	$2,359.46	
July 1, 1893, amount covered by uncompleted contracts	5,063.94	
		7,423.40
July 1, 1893, balance available		668.45

(See Appendix E 11.)

12. Raritan Bay, New Jersey.—Raritan Bay forms the western part of the large triangular bay inclosed between Sandy Hook, the New Jersey shore, and Staten Island.

The channel undergoing improvement lies to the southeast of Seguine Point on the south shore of Staten Island. At the time of the original survey, August, 1880, the least depth on the shoal lying between the 21-foot curve at Seguine Point and the 21-foot curve at the head of the bay was 14½ feet, mean low water. The project of improvement, based upon the survey, provided for a channel across the shoal 300 feet wide and 21 feet deep, mean low water, at an estimated cost of $126,500.

The project was enlarged in 1885, providing for a channel of equal width and depth over the shoals in the vicinity of Wards Point, Staten Island, where the original depth was 18 feet, mean low water, giving a navigable channel 21 feet deep, mean low water, up to Perth Amboy; and further providing for a channel 300 feet wide and 15 feet deep, mean low water, from Great Beds Light to South Amboy, where the original depth was 12½ feet, mean low water, at an estimated total cost of $240,500, for the two works from the beginning, which estimate was again increased in 1888 to $246,500, to provide for the removal of deposits which had taken place in the interval of three years.

The channel from deep water at the head of Raritan Bay, past Seguine Point to Perth Amboy, exceeds 5 miles in length, is crooked, and is subject to constant shoalings. As the amount appropriated any one year for the execution of the project has been much less than the estimated cost of the improvement, and as the channel excavated under each appropriation has been impaired by shoaling in a greater or less degree before work could be resumed under the succeeding appropriations, the original estimates for this improvement have little value and can not be used for determining the amount required for completing the project at this date. The cost of completing the project, if all the required money could be made available at one time, was estimated in 1891 at $175,375.

The amount expended upon the modified project of 1885, up to the close of the fiscal year ending June 30, 1892, inclusive of outstanding liabilities, was $221,276.85. At the close of the contract, June 15, 1888, the channel was 300 feet wide and 21 feet deep, mean low water, from Perth Amboy to the bend at Great Beds Light, and 300 feet wide and 20 feet deep, mean low water, across the crest of the shoal in the chan-

nel leading from the bend toward Seguine Point. At the close of the year the channel eastward of Seguine Point was 180 feet wide, with a depth of 21 feet, mean low water, and the channel from Great Beds Light to South Amboy was 170 feet wide and 15 feet deep, mean low water.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $35,201.54, and was applied in dredging 81,831 cubic yards of material from channel leading from Great Beds Light to South Amboy, and 88,250 cubic yards of material from Seguine Point Channel.

At the close of the fiscal year ending June 30, 1893, the channel leading eastward from Seguine point is 250 feet wide and 21 feet deep, mean low water, and the channel from Great Beds Light to South Amboy is 300 feet wide and 15 feet deep, mean low water.

July 1, 1892, balance unexpended		$1,295.96
Amount appropriated by act approved July 13, 1892		40,000.00
		41,295.96
June 30, 1893, amount expended during fiscal year		20,107.45
July 1, 1893, balance unexpended		21,188.51
July 1, 1893, outstanding liabilities	$15,094.09	
July 1, 1893, amount covered by uncompleted contracts	2,931.24	
		18,025.33
July 1, 1893, balance available		3,163.18
Amount (estimated) required for completion of existing project		95,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		95,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix E 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—The schooner *Wild Pigeon* was removed from the east side of main ship channel, New York Harbor, May 10, 1893, under contract with the Chapman Derrick and Wrecking Company, at a cost of $3,500.

The wreck of an old canal boat was removed from the Bronx River, about one-half mile below West Farms, in June, 1893, under contract with George McClintock, at a cost of $100.

(See Appendix E 13.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. G. L. Gillespie, Corps of Engineers, and reports thereon submitted.

1. Fort Pond Bay, east end of Long Island, New York.—Lieut. Col. Gillespie submitted report of examination under date of November 9, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 110, Fifty-second Congress, second session. (See also Appendix E 14.)

2. The channel west of Robbins Reef Light-House to connect the mouth of Arthur Kill with New York Harbor.—Lieut. Col. Gillespie submitted report of examination under date of August 1, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Con-

gress and printed as House Ex. Doc. No. 77, Fifty-second Congress, second session. (See also Appendix E 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHWESTERN PART OF LONG ISLAND AND NEAR STATEN ISLAND, NEW YORK, AND IN NORTHEASTERN NEW JERSEY.

This district was in the charge of Capt. Thos. L. Casey, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Sumpawanus Inlet, New York.—The channel depth at the time of the adoption of the project varied from 5 feet in the bay at mean low water to 2 feet at the wharf at the mouth of the creek, a distance of a little over half a mile.

The project for the improvement of this inlet, adopted in 1880, provides for dredging a channel 4,500 feet long and from 100 to 150 feet wide and 5 feet deep at mean low water, beginning at the 5-foot curve in the Great South Bay and extending up to the town of Babylon, Long Island, at an estimated cost of $23,115.

The amount expended under this project to June 30, 1892, was $7,000.

With this amount a channel 75 feet wide and 5 feet deep from the steamboat wharf to a point 750 feet below it was dredged, besides dredging two cuts, each 25 feet wide, alongside the wharf.

Outside of the cuts so made and extending to the 5-foot curve in the bay a shoal was left, on which the depth was only 4¾ feet.

The commerce of the inlet is reported for the calendar year 1892 to be 1,420 tons, against 1,427 tons for 1891.

There were no expenditures on account of this work during the fiscal year ending June 30, 1893, there being no funds available.

Amount (estimated) required for completion of existing project	$16,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 1.)

2. Canarsie Bay, New York.—The original condition of the channel leading to Canarsie answered to a depth of 4½ feet, mean low water.

The original project, adopted in 1879, at an estimated cost of $88,000, provides for obtaining a navigable channel 6 feet deep at mean low water from Canarsie Landing to the deep water in Jamaica Bay by means of diking and the formation of a tidal basin. In the Annual Report of the Chief of Engineers, 1880, part 1, p. 574, Gen. Newton expressed a doubt as to adequate appropriations being made for carrying out the authorized project, and suggested that dredging be tried as an expedient.

The amount expended to the close of the fiscal year ending June 30, 1892, was $47,944.13.

With this amount two pile dikes have been built and maintained, one on the north side of the outer end of the channel, the other on the south side, their lengths being 1,058 and 820 feet, respectively; the channel dredged to a depth of 6 feet, mean low water, and width of 125 feet from Canarsie Landing to deep water in Jamaica Bay. In addition to this several other improvements, not contemplated in the main project, but which added materially to the facility of navigation, viz, the excavation of a cut 100 feet long and 50 feet wide, with a depth of 6 feet, on the east side of the steamboat landing at Canarsie, and a cut at the end of the wharf at Canarsie Landing extending through to the south-

west to connect with the Southwest Channel, the latter for the purpose of promoting tidal circulation.

The work during the fiscal year consisted in dredging the Main and West channels to the required dimensions, the former to a width of 150 feet and mean low-water depth of 6 feet and the latter to a width of 60 feet and mean low-water depth of 4 feet, under contract entered into with J. H. Fenner of Jersey City, April 15, 1893. Operations were begun by the contractor May 23, 1893, and were still in progress at the close of the fiscal year, 7,867 cubic yards of material having been removed.

The commerce for the calendar year 1892 is reported to be 67,510 tons, against 56,210 tons for 1891.

July 1, 1892, balance unexpended		$55.87
Amount appropriated by act approved July 13, 1892		5,000.00
		5,055.87
June 30, 1893, amount expended during fiscal year		591.75
July 1, 1893, balance unexpended		4,464.12
July 1, 1893, outstanding liabilities	$2,649.37	
July 1, 1893, amount covered by uncompleted contracts	1,350.63	
		4,000.00
July 1, 1893, balance available		464.12

Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 2.)

3. Sheepshead Bay, New York.—The original condition of the navigable channel was, for the entrance, a depth of a little over 2 feet at mean low water, and for the interior channel not less than 4 feet, except at two narrow bulkheads across said channel.

The originally adopted project (1879) was to deepen the entrance by means of converging jetties and to improve the interior channel by longitudinal dikes, so placed as in some instances to form tidal reservoirs for the scour of the channel. The project was revised in 1881 and provides for excavating a channel at the outlet 100 feet wide and 6 feet deep at mean low water, to connect the bay with Dead Horse Inlet, and to dredge the interior channel; this was modified in February, 1889, the modified project contemplating a channel 5,350 feet long, 60 feet wide, and 5½ feet deep, mean low water, from the town of Sheepshead to within 1,080 feet of Dead Horse Inlet Cut, to connect with the channel of similar width and depth already existing at that point.

The amount expended on this project to the end of the fiscal year ending June 30, 1892, was $25,943.45.

With this amount a channel had been dredged 100 feet wide and 6 feet deep at mean low water, connecting the east end of the bay with Dead Horse Inlet, and the interior channel dredged 60 feet wide and 5½ feet deep, at mean low water, for a distance of 3,400 feet from the town of Sheepshead toward Dead Horse Inlet. The first mentioned channel, from a survey in 1887, was observed to have not maintained itself, having contracted to a width of 60 feet with an average depth of 5½ feet, mean low water.

The commerce of the bay has increased, being reported for the calendar year 1892 to be 132,000 tons, against 106,400 for 1890.

July 1, 1892, balance unexpended	$172.57
June 30, 1893, amount expended during fiscal year	116.02
July 1, 1893, balance unexpended	56.55
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	8,200.00

(See Appendix F 3.)

4. Arthur Kill, New York and New Jersey.—A history of this improvement, which originated by special resolution in the Senate, is given in the Annual Report of the Chief of Engineers, 1889, Part I, p. 819.

The improvement consists in the removal of a point of land near and to the south of the Staten Island Bridge for the purpose of straightening the channel, in order that the currents may be directed more truly in a direction perpendicular to the draw-span of the bridge, thus facilitating the passage of long tows. It is estimated to cost $26,500.

A statement of condemnation proceedings for acquiring to the United States the land needed for this improvement will be found in the Annual Report of the Chief of Engineers for 1890, Part I, p. 843.

Sixteen thousand two hundred and forty-five dollars and fifty-nine cents had been expended up to June 30, 1892, in acquiring land and in dredging off about 1 acre of the point, with a resulting increase of 210 feet in the channel width and uniform mean low-water depth of 13 feet, where the land was originally 6 feet above that plane.

The expenditures during the fiscal year ending June 30, 1893, amount to $4,845.15, with which the channel was given an additional width of from 15 to 60 feet and mean low-water depth of 13 feet, one-third acre of the land removed, making a total of about 1⅓ acres removed under the project, giving a total channel width at this point of not less than 725 feet.

The commerce for the calendar year 1892 is reported to be 4,835,004 tons, against 6,947,635 tons for 1891.

July 1, 1892, balance unexpended	$754.41
Amount appropriated by act approved July 13, 1892	5,000.00
	5,754.41
June 30, 1893, amount expended during fiscal year	4,845.15
July 1, 1893, balance unexpended	909.26
Amount (estimated) required for completion of existing project	4,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	4,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 4.)

5. Channel between Staten Island and New Jersey.—Before this improvement was undertaken by the United States there was a navigable channel having a minimum depth of 9.2 feet from the deep water in Newark Bay to Elizabethport.

The first project for the improvement of the channel was made in 1873. This provided for dredging it to a depth of 16 feet for a width of 150 feet at its shallowest part, and protecting the cut by parallel dikes. The estimated cost of this was $443,210.

This project was changed in 1880 so as to dredge a channel 400 feet wide and 13 feet deep over the middle 200 feet of its width, leaving it but 12 feet deep over the remaining widths of 100 feet on each side.

The estimated cost of this work was $125,705. In addition to this it was proposed, should it be found necessary, to build four detached dikes along the line of the channel, two on the north and two on the south side, the estimated cost of which was $60,000, bringing the total estimated cost of the proposed improvement up to $185,705. Subsequently it was decided to give the channel 13 feet depth for its full width of 400 feet, increasing the estimate to $210,000.

A modification of this project, having in view the abandonment of the dikes, was submitted May 9, 1889, and was approved by Department letter dated May 15, and a further modification, calling for a uniform channel depth of 14 feet at mean low water over the entire width of 400 feet, was approved October 20, 1890.

The amount expended to June 30, 1892, was $197,276.38.

With this amount 2,237 feet of dike was built, the channel dredged throughout its entire projected length to a mean low-water depth of 13 feet, with widths varying from 300 to 350 feet, and in the vicinity of the bend at the Corner Stake Light, for a distance of 3,000 feet, the width had been increased to 400 feet, with mean low-water depths of from 13 to 14 feet.

An appropriation of $15,000 was made in the river and harbor act of July 13, 1892, and a project for its expenditure in dredging the channel to the required dimensions was approved July 26, 1892.

No work has been done during the fiscal year, operations under the above project having been deferred until a survey is made, and the most appropriate localities for the expenditure of the appropriation thereby determined. It is also expected that a more advantageous letting of the work can be had later in the season.

The amount of commerce reported for the calendar year 1892 is 3,643,914 tons, against 9,219,481 tons for 1891.

July 1, 1892, balance unexpended		$1,723.62
Amount appropriated by act approved July 13, 1892		15,000.00
		16,723.62
June 30, 1893, amount expended during fiscal year		967.50
July 1, 1893, balance unexpended		15,756.12
Amount (estimated) required for completion of existing project		46,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix F 5.)

6. Passaic River, New Jersey.—This river is being improved under two separate projects, the first applying to the river below Center Street Bridge, Newark, to and beyond the shoals in Newark Bay, a distance of 7⅝ miles, and the second to the upper course of the river from Center Street Bridge as far as Passaic, a distance of 8 miles. The most recent appropriation was, however, made in a single sum for the entire river, and the two projects will hereafter be united, so that the funds can be expended at those parts of the river most urgently needing control or repair in the interests of navigation.

a. Below Newark.—The lower portion of the river, from Center Street Bridge to Newark Bay, was first surveyed by the Engineer Department in 1879. The greatest depth in the channel at a point above the Elbow Beacon was only 7.1 feet, and in many places the greatest depth was 7.5 feet at mean low water.

A project was adopted, based on this survey, providing for obtaining

by diking and dredging a channel 200 feet wide and 10 feet deep at mean low water from the Center Street Bridge to Newark Bay, at a cost of $232,875.

This project was modified in 1884, pursuant to the river and harbor act of that year, providing for extending the dike at the mouth of the river into the bay, a distance of 12,000 feet, and for dredging a channel across the shoal in Newark Bay 200 feet wide and 10 feet deep at mean low water, increasing the original estimate to $353,875.

The amount expended to June 30, 1892, was $233,692.18.

With this amount 6,205 feet of dike had been built and maintained, the channel through the shoal in the bay and the channel up the river as far as Lister Dock dredged to the required dimensions, and a bar above the Zinc Works Dock removed to the required depth, with a width of 120 feet for a distance of 1,600 feet up stream. A survey made in December, 1892, shows that the above conditions have been fairly well maintained.

The work done during the fiscal year consisted in making a survey of Newark Bay from Bayonne, N. J., to the Newark and New York Railroad Bridge, and of the river from Baeder and Adamson Dock to Center Street Bridge, Newark, and in dredging under a contract with P. Sanford Ross, for the removal of about 60,000 cubic yards of material from the channel in the river between Center Street Bridge and Lister Dock, Newark. Work under the contract was begun June 14 and was in progress at the close of the fiscal year, 11,294 cubic yards having been removed at that date. The expenditures during the year amount to $2,591.06, for surveying, inspection, and administration.

b. Above Newark.—Before its improvement was undertaken the upper part of the river had a navigable 6-foot channel, except at Middle, Belleville, Rutherford Park, and Holzman Bars, where the depths were 4.5 feet, 3.9 feet, 3 feet, and 3.5 feet, respectively.

The project of improvement was adopted in 1872, and provided for a channel across and above the shoals from 7½ to 6 feet deep, mean low water, and from 200 to 50 feet wide, to be obtained by dredging and diking at a cost of $123,924. It was modified in 1885 by extending the channel below Middle Bar 1,500 feet to the Erie Railroad Bridge, increasing the estimate to $129,000, which was further increased in 1886 to $133,762. A further modification, to include the removal of Third River Bar, the redredging of bars formed by freshets, and removal of bowlders at various points in the river, increasing the estimate to $193,822, was approved October 6, 1890.

The amount expended to June 30, 1892, was $135,677.06, with which channels had been dredged to the requisite depth, with widths of from 60 to 75 feet, a channel through Third River Bar dredged to the required depth, with width of 100 feet for a distance of 800 feet, and below this bar the channel was increased in width by 40 feet, with the same depth for a distance of 700 feet, and by 20 feet for a further distance of 245 feet, giving a continuous channel through this reach having a width of 100 feet and depth of 6 feet, mean low water.

The expenditures during the fiscal year ending June 30, 1893, amount to $2,807.91, and operations were confined to dredging at Belleville and Rutherford Park bars, under a contract entered into with James McSpirit, of Jersey City, September 24, 1892. Work began October 5, 1892, and is still in progress, 5,200 cubic yards of material having been removed to date. Under this contract the channel through Belleville Bar was completed to the required width of 100 feet and mean low-

water depth of from 6 to 7 feet, by the removal of 2,105 cubic yards of material.

The commerce of the entire river for the calendar year 1892 is reported to be 1,362,647 tons.

As the river and harbor act approved July 13, 1892, makes the appropriation for the two reaches of the river under one heading, the following consolidated money statement for Passaic River is presented:

July 1, 1892, balance unexpended:		
Below Newark	$5,807.82	
Above Newark	3,172.94	
		$8,980.76
Amount appropriated by act approved July 13, 1892		45,000.00
		53,980.76
June 30, 1893, amount expended during fiscal year:		
Below Newark	2,591.06	
Above Newark	2,807.91	
		5,398.97
July 1, 1893, balance unexpended		48,581.79
July 1, 1893, outstanding liabilities	5,312.49	
July 1, 1893, amount covered by uncompleted contracts	20,744.15	
		26,056.64
July 1, 1893, balance available		22,525.15
Amount (estimated) required for completion of existing project		124,347.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix F 6.)

7. Elizabeth River, New Jersey.—This stream, which is 2⅝ miles in length from its mouth to the head of navigation, at Broad street, Elizabeth, has a width of from 50 to 90 feet, and before its improvement the wharves in the city could only be reached at high water by vessels drawing less than 4 feet; its commerce was estimated at 45,000 tons annually. The range of the tide was about 4.7 feet at its mouth and 3.4 feet at Bridge street.

The project for the improvement was adopted in 1878 and provides for obtaining, by dredging, a channel 60 feet wide and 7 feet deep at high water from the mouth of the river to the head of navigation, at an estimated cost of $25,530; this was increased in 1882 to $43,160, the increase being due to advanced prices.

The amount expended under this project to June 30, 1892, was $31,886.20.

With this amount the channel had been dredged in 1883 to the required depth to within 1,000 feet of Broad Street Bridge, but soon became obliterated by reason of deposits of silt and sewage refuse. It was redredged in 1891, shoals being removed from the river at the bend above South street, at South Street Bridge, at John street, at the bend in the river below John street, and at the New York and Long Branch Railroad Bridge to a depth of 7 feet at mean high water, with widths of 30 to 50 feet, giving a 7-foot mean high-water channel with widths varying from 30 to 50 feet from the mouth of the river to within 900 feet of Bridge Street Bridge, in the town of Elizabeth.

A survey made in November, 1892, indicates a channel from 30 to 50 feet wide, extending from the mouth to Bridge Street Bridge, the head of navigation, with mean high-water depths of from less than 5 feet to more than 7 feet.

No active operations have been in progress during the fiscal year, as no bids were received in response to public advertisement of February 18, 1893, inviting sealed proposals for dredging, at date of opening, March 29, 1893. It is expected that an advantageous offer may be received for doing the work by hired labor, later in the season.

The commerce of the river for the calendar year 1892 is reported to be 39,575 tons against 36,225 tons for 1891.

July 1, 1892, balance unexpended	$113.80
Amount appropriated by act approved July 13, 1892	5,000.00
	5,113.80
June 30, 1893, amount expended during fiscal year	467.26
July 1, 1893, balance unexpended	4,646.54

Amount (estimated) required for completion of existing project	6,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,160.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 7.)

8. Rahway River, New Jersey.—In its original condition the Rahway River had a depth of 8 feet and more at mean high water from its mouth to Bricktown, 3⅝ miles; 7 feet to Edgar Dock, 4⅛ miles; 4.4 feet to Milton Avenue Bridge, 4¾ miles; and 4 feet to Main Street Bridge, 5 miles, in the town of Rahway. Its commerce was estimated at 120,000 tons, and three attempts had been made to establish a line of steamboats on the river, but had failed on account of the bad condition of the stream.

The original project for its improvement was adopted in 1878, and provides for dredging a channel 125 feet wide and 8 feet deep at high water from Bricktown to Milton Avenue Bridge, and 100 feet wide from that point to Main Street Bridge, at an estimated cost of $66,250.

The amount expended on this improvement to June 30, 1892, was $37,000.

With the above amount the channel had been given a depth of 7 feet at mean high water and width of from 100 to 50 feet to within 550 feet of the head of navigation.

There has been no appropriation for this work since 1882 and there have been no funds for expenditure since the fiscal year ending June 30, 1890. The channels have reverted nearly to their original condition.

Amount (estimated) required for completion of existing project	$29,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	29,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 8.)

9. Raritan River, New Jersey.—Before its improvement by the United States the Raritan River had a depth of 8.5 feet at "The Stakes," 3 miles; of 6.5 feet at the "Middle Grounds," 4½ miles; of 7.5 feet at Whitehead Sand Dock, 8½ miles; and between this point and New Brunswick, 12¼ miles above the mouth, the channel was obstructed by a number of rocky shoals, with depths of from 8.4 to 6.9 feet at mean low water. The city of New Brunswick and the Delaware and Raritan Canal, which terminates here, together with extensive brickyards on the South River, did a large commerce, estimated in 1871 at 3,053,857 tons per annum.

The present project was adopted in 1874, and provides for obtaining by diking and dredging, and where necessary by drilling and blasting rock, a channel 200 feet wide and 10 feet deep, mean low water, from the mouth to New Brunswick, at a cost of $2,093,662.05. It was modified in 1881, pursuant to the river and harbor act of that year, by adding to it the dredging of the South Channel, about 13,000 feet long, 100 feet wide, and 5½ feet deep at mean low water, from Kearney Dock to Crab Island.

The amount expended to June 30, 1892, under this project was $555,489.18.

The above amount was expended in the construction and maintenance of certain dikes required by the project at "The Stakes" and "Middle Ground," in dredging channels 200 feet wide and 12 feet deep at mean low water at these points, and in blasting and dredging a channel of the same dimensions across the rocky shoal at Whitehead Sand Dock, and thence up the river with a width of 100 feet and depth of 10 feet to within 2,280 feet of the canal lock at New Brunswick. Under two special allotments made for it in the acts of March 3, 1881, and August 2, 1882, the South Channel was dredged to the required depth for a distance of 4,000 feet. These improvements have been of great benefit to navigation, permitting the large tows in use on the river to reach a point 2,280 feet below New Brunswick at all stages of the tide. The commerce of the river is reported for the calendar year 1892 to be 1,120,302 tons, against 1,566,888 tons for 1891.

The expenditures during the fiscal year amount to $21,877.09. With this amount the channel has been given a width of 100 feet and depth of about 10 feet, at mean low water, for a distance of 400 feet, through a river bed of extremely hard shale rock, bringing the 100-foot channel to within 1,880 feet of the canal lock at New Brunswick; the channel to Acken Dock redredged to a width of 50 feet and depth of 6 feet at mean low water, for a distance of about 600 feet, and repairs to the dikes at the "Middle Grounds" completed.

July 1, 1892, balance unexpended	$15,760.82
Amount appropriated by act approved July 13, 1892	40,000.00
	55,760.82
June 30, 1893, amount expended during fiscal year	21,877.09
July 1, 1893, balance unexpended	33,883.73
July 1, 1893, outstanding liabilities	3,116.73
July 1, 1893, balance available	30,767.00
Amount (estimated) required for completion of existing project	1,482,412.05
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 9.)

10. South River, New Jersey.—Before the improvement of this stream was undertaken by the United States the navigation of the lower 2½ miles of its course had been abandoned and a private canal dredged from near Washington to Sayreville, on the Raritan River. In 1880, when the present project for improving the river was adopted, the mouth of this canal, on account of its faulty location, had shoaled considerably. Above Washington a depth of 2.7 feet existed to Bissetts, 3⅝ miles, and of 2.5 feet to Old Bridge, the head of navigation, 6¼ miles above the mouth of the canal at Sayreville.

The project adopted in 1880 provided for closing the river below the head of the canal, correcting the direction of the mouth of the latter and obtaining by diking and dredging a depth of 8 feet, mean low water, to Washington, 6 feet to Bissetts, and 4 feet to Old Bridge, straightening the channel at two points by cutting across the meadow; estimated to cost $194,695. This was modified July 30, 1892, by omitting the proposed cut-off and dikes and substituting therefor the dredging of the river between Washington and the Raritan River Railroad Bridge, removing 39,000 cubic yards of material, reducing the original estimate to $176,975.

The amount expended under this project to June 30, 1892, was $69,552.87.

With this amount the direction of the mouth of the canal had been changed, the dikes below Washington completed and maintained, a small amount of dredging done on a shoal above Washington, a shoal at the mouth of Washington Canal removed, and a channel dredged 60 feet wide through the canal and 50 feet wide across the shoal in the river below Washington. The channel below the draw of the Raritan River Railroad Bridge was given a depth of 4 feet at mean low water, with additional width of 25 feet for a distance of 350 feet, and for a like distance above the bridge the width was increased to 70 feet. At Rourke Reach the channel was given a depth of 6 feet at mean low water, and width of 60 feet for a distance of 860 feet; in addition a bar opposite Whitehead's brickyard was removed to a depth of 8 feet at mean low water, and width of 60 feet for a distance of 450 feet, and at the junction of the canal and South River a channel was excavated 350 feet long, 60 feet wide, and 6 feet deep at mean low water.

The expenditures during the fiscal year ending June 30, 1893, amount to $6,486.10. With this amount the channel was given a depth of 6 feet at mean low water, with widths of from 50 to 100 feet for a distance of 1,850 feet, extending from the Turnpike Bridge and connecting with a channel of similar depth, existing as far as the Raritan River Railroad Bridge; a width of 100 feet being maintained for the first 200 feet of its length, 75 feet for an additional 585 feet, and 50 feet for the remainder.

The present condition of the river is such that it may be navigated at any stage of the tide by vessels of 6 feet draft for a distance of about 3 miles above its mouth.

The commerce of the river was reported for the calendar year 1891 to be 370,335 tons and for the calendar year 1892 it is given as 162,462 tons.

July 1, 1892, balance unexpended	$1,447.13
Amount appropriated by act approved July 13, 1892	7,000.00
	8,447.13
June 30, 1893, amount expended during fiscal year	6,486.10
July 1, 1893, balance unexpended	1,961.03
Amount (estimated) required for completion of existing project	98,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 10.)

11. Keyport Harbor, New Jersey.—Keyport Harbor was originally accessible at low water only to vessels drawing less than 4 feet. Before its improvement was undertaken by the United States a 6-foot channel

had been dredged at private expense, which had shoaled in 1872 to 5½ feet and in 1882 to 5 feet, the range of the tide being 4.7 feet. A large commerce was carried on, however, valued at $2,932,000.

The project for the improvement was adopted in 1873 and provided for dredging a channel 4,700 feet long, 8 feet deep at mean low water, and 200 feet wide from the steamboat dock to the 8-foot contour in Raritan Bay, at an estimated cost of $30,475. The revised estimate of 1884 was $40,475.

The amount expended on this improvement to the close of the fiscal year ending June 30, 1892, is $30,475.

With the above amount a channel had been dredged from the 8-foot depth in Raritan Bay to Keyport Wharf, a distance of 5,000 feet, with a width of 200 feet for the first 4,200 feet and 160 feet for the remainder. A survey made in October, 1892, shows that this channel has not maintained itself, having contracted to widths of from 60 to 175 feet with mean low-water depths of from 6 to 8 feet.

There had been no appropriation for this work since 1882, until July 13, 1892, when $5,000 was made available by the river and harbor act of that date.

The expenditures during the fiscal year ending June 30, 1893, amount to $4,914.32 with which the channel in front of the steamboat dock was dredged to the required mean low-water depth of 8 feet, and widths of from 70 to 140 feet for a distance of 400 feet, thence for a distance of 2,200 feet outward, a cut 35 feet wide was dredged to a similar depth along the northerly side of the old channel.

The commerce is reported for the calendar year 1892 to be 358,391 tons, against 241,252 tons for 1891.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	4,914.32
July 1, 1893, balance unexpended	85.68
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 11.)

12. Mattawan Creek, New Jersey.—Before its improvement by the United States this small stream was obstructed at its entrance into Keyport Harbor by a mud flat, on which the best depth at the worst section was 3.1 feet at mean low water, though the 3-foot channel was too narrow and tortuous for use. Above this flat a good 4-foot channel existed to 1⅛ miles above the mouth, and thence to the steamboat dock at Mattawan 3.5 feet, shoaling to 1.8 feet at the freight dock 600 feet above and 1⅞ miles from the mouth. The range of the tide is 4.7 feet. Notwithstanding the above difficulties it carried commerce valued in 1880 at $800,000.

The project for the improvement was adopted in 1881 and provides for dredging a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Winkson Creek, and thence 75 feet wide to the railroad bridge at Mattawan, 250 feet above the freight dock, at an estimated cost of $33,120.

To June 30, 1892, the amount expended under this project was $23,485.87.

With this amount channels had been dredged in 1881 and 1882 to the required depth from the mouth to the freight dock at Mattawan, with widths varying from 100 to 30 feet, and, in 1891, a cut 35 feet wide

was redredged to the required depth along the northerly side of the channel for a distance of 1,420 feet upstream from the mouth of the creek.

A survey made in November, 1892, shows that the channels dredged in 1881 and 1882 have almost reverted to their original condition, hence the appropriation available for completing the improvement in accordance with the approved plans will be insufficient for that purpose.

Work during the fiscal year consisted in dredging under a contract entered into with Alonzo E. Smith, of Islip, N. Y., May 3, 1893, for the removal of about 25,000 cubic yards of material. Operations were begun June 24, and at the close of the fiscal year 2,617 cubic yards had been removed.

The commerce for the calendar year 1892 is reported to be 326,500 tons, against 199,850 tons for 1891.

July 1, 1892, balance unexpended		$14.13
Amount appropriated by act approved July 13, 1892		9,620.00
		9,634.13
June 30, 1893, amount expended during fiscal year		635.71
July 1, 1893, balance unexpended		8,998.42
July 1, 1893, outstanding liabilities	$706.59	
July 1, 1893, amount covered by uncompleted contracts	6,893.41	
		7,600.00
July 1, 1893, balance available		1,398.42

(See Appendix F 12.)

13. Shoal Harbor and Compton Creek, New Jersey.—Shoal Harbor is an indentation of the shore on the south side of Sandy Hook Bay, 5 miles west of the entrance to Shrewsbury River. It is bare at low water and the water deepens so gradually outward that the 5-foot curve, mean low water, is only reached at a distance of 3,000 feet from the high-water line. Compton Creek, which flows into Shoal Harbor, is 5 to 6 miles long with 3 to 5 feet of water in the lower reach. At one-quarter of a mile from its mouth it is crossed by a fixed bridge, which limits navigation. Between this bridge and the harbor there is a harbor of refuge of limited capacity, having a depth of 9 feet in places, to which fishing vessels resort when the tides allow them to cross the shoal at the entrance. The range of tides is 4.5 feet.

The plan of improvement adopted in 1884 had in view the connection of the 5-foot mean low-water curve of the creek on the inside with the 5-foot curve of the bay by means of a dredged channel 150 feet wide, and the protection of this channel against shoaling by means of a timber dike placed on the west side of the harbor, at a total estimated cost of $64,130.

The amount expended to the close of the fiscal year ending June 30, 1892, was $5,000, with which the channel was dredged to a mean low-water depth of 4½ feet for a distance of 1,200 feet, beginning near the bulkhead at the mouth of the creek, with a width of 100 feet for the first 800 feet, and 70 feet for the remainder.

A survey made in October, 1892, shows that this channel has not maintained itself, having contracted to widths of from 60 to 80 feet and mean low-water depth of from 3.2 feet to 4.2 feet.

An appropriation of $3,000 was made in the river and harbor act of July 13, 1892.

No work has been done during the fiscal year, as no bids were received

under advertisement of February 18, 1893, inviting proposals for extending the channel through Shoal Harbor toward Raritan Bay by dredging.

The commerce of the creek has increased, being reported for the calendar year 1892 as 62,000 tons against 48,000 tons for 1891.

Amount appropriated by act approved July 13, 1892	$3,000.00
June 30, 1893, amount expended during fiscal year	139.29
July 1, 1893, balance unexpended	2,860.71
Amount (estimated) required for completion of existing project	56,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 13.)

14. Shrewsbury River, New Jersey.—When the present project for this improvement was adopted in 1879, the river was obstructed by a number of shifting sand bars, which had caused the complete suspension of navigation in the South Branch, and only permitted the passage of vessels engaged in commerce up the North Branch at or near high water. A considerable trade was carried on, however, even under these difficult conditions.

The project originally adopted was to dredge a channel 6 feet deep at mean low water, and from 300 to 150 feet in width across the shoals from the mouth to Red Bank on the North Branch, 8 miles, and Branchport on the South Branch, 9 miles, maintaining these channels by longitudinal dikes. This project has not been modified as to the end sought, but estimates of the diking, dredging, and cost have been increased from time to time.

The amount expended on this project to June 30, 1892, was $224,459.68.

With this amount numerous dikes have been built and maintained and channels dredged and redredged in various parts of both branches and main stem 6 feet deep and from 25 to 100 feet wide.

The expenditures during the fiscal year amount to $3,186.87.

The work during the fiscal year consisted in making necessary repairs to the dikes at the mouth and in the North Branch, and in redredging channels at various points in the river under contract with Edgar M. Payn, of Albany, N. Y., for the removal of about 20,000 cubic yards of material. Work was begun May 6 and was completed at the close of the fiscal year, 18,565 cubic yards having been removed, resulting in the formation of channels of the required depth through various shoals in both branches of the river.

The commerce of the river was reported for the calendar year 1891 to be 623,000 tons. This has increased to 672,000 tons for the calendar year 1892.

July 1, 1892, balance unexpended	$40.32
Amount appropriated by act approved July 13, 1892	10,000.00
	10,040.32
June 30, 1893, amount expended during fiscal year	3,186.87
July 1, 1893, balance unexpended	6,853.45
July 1, 1893, outstanding liabilities	5,173.01
July 1, 1893, balance available	1,680.44
Amount (estimated) required for completion of existing project	20,062.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,062.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F 14.)

15. Manasquan (Squan) River, New Jersey.—In its original condition this stream had a depth of from 4 to 6 feet at mean low water for several miles above its mouth, but was obstructed at its outlet into the ocean by a sand spit, which had deflected the stream into a channel parallel with the beach, communicating with the ocean across shifting sand bars, on which the best depth did not exceed 1½ feet at mean low water; mean range of tide, 2.4 feet. In severe storms this channel was sometimes entirely closed by sand, remaining so until the fresh water in the river had accumulated sufficiently to force a new outlet. Under these conditions the river could not be used by commerce.

The project for its improvement was adopted in 1879, and contemplated dredging the lower river and obtaining, by means of jetties, a permanent outlet nearly at right angles to the beach, with a depth of 6 feet at mean low water, at an estimated cost of $52,120. This was increased to $72,000 in 1882, the increase being due to advanced prices and to a proposed increase in the length of the jetties.

The amount expended under this project to June 30, 1892, was $39,000.

With this amount two jetties had been constructed, but neither to its full length, appropriations having ceased in 1882. No permanent improvement had been effected.

An appropriation of $2,000 was made in the act of September 19, 1890, to be expended in the removal of obstructions placed by the Government at the mouth of the river, if, in the discretion of the Secretary of War, the same should be done. There were no expenditures during the fiscal year ending June 30, 1893, as the removal of the obstructions alluded to in the act of September 19, 1890, was, in the opinion of the engineer in charge, deemed unnecessary, and so reported under date of December 19, 1890, and was approved by the Secretary of War December 30, 1890.

July 1, 1892, balance unexpended	$2,000.00
July 1, 1893, balance unexpended	2,000.00
Amount (estimated) required for completion of existing project	31,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix F 15.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. Thos. L. Casey, Corps of Engineers, and reports thereon submitted through the division engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Seaford Creek, Long Island, New York.—Capt. Casey submitted report of examination under date of September 22, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the creek is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 38, Fifty-second Congress, second session. (See also Appendix F 16.)

2. Channel connecting Freeport with Great South Bay, New York.—Capt. Casey submitted report of examination under date of September 23, 1892. It is the opinion of the division engineer, concurred in by this office, that the locality is not worthy of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 65, Fifty-second Congress, second session. (See also Appendix F 17.)

3. Whale Creek, New Jersey.—Capt. Casey submitted report of examination under date of October 4, 1892. It is his opinion and that of the

division engineer, concurred in by this office, that the creek is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 89, Fifty-second Congress, second session. (See also Appendix F 18.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY; OF DELAWARE RIVER AND BAY, AND OF WATERS TRIBUTARY THERETO, NEW JERSEY, PENNSYLVANIA, AND DELAWARE.

This district was in the charge of Maj. C. W. Raymond, Corps of Engineers, with Lieut. Albert M. D'Armit, Corps of Engineers, under his immediate orders to June 14, 1893; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Delaware River, New Jersey and Pennsylvania.—Trenton, the head of natural navigation on the Delaware River, is about 30 miles above the upper part of the port of Philadelphia. In its original condition this part of the river was obstructed by shoals at the following localities: Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed, which carried from 3 to 6 feet at mean low water; at Kinkora Bar, about 9 miles below Trenton, a shoal carrying from 7 to 8 feet, and at Five Mile Bar, at the upper part of Philadelphia, a shoal across the Pennsylvania channel carrying only 3 to 4 feet at mean low water, there being, however, 13 feet of water past Five Mile Bar, in the New Jersey channel, passing south of Petty Island.

Below Philadelphia the river, in its original condition, presented obstructions at Mifflin Bar which reduced the depth at mean low water to 17 feet, at Schooner Ledge and Cherry Island Flats to 18 feet, at Bulkhead Shoal and Dan Baker Shoal to about 20 feet.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river, and deepening the channel across Kinkora Bar.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner Ledge, where solid rock was removed, under appropriations for special localities and also under general appropriations for the Delaware River below Bridesburg.

A board of engineers, convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended under date of January 23, 1885, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Shipbuilding Company's yard and the Gas Trust Wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel is to be obtained, except at Schooner Ledge, where rock would require to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging, where necessary, as an aid to such contracting and regulating works. The estimated cost of obtaining a channel of the above dimensions is about $2,425,000, which covers the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. This estimate of cost does not include the improvement of Philadelphia Harbor, which is a separate project. With the present requirements of commerce above Philadelphia, it is not considered that the part of the river lying between Trenton and Bridesburg demands any further improvement.

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1892, under appropriations both for special localities and the general river, was $2,080,721.76, of which $118,500 was expended on that part of the river between Trenton and the upper part of Philadelphia. As a result of this expenditure there had been formed at the latter date a channel of navigable width and 7½ feet deep at mean low water through the bars between Bridesburg and Bordentown; a channel across Kinkora Bar 7½ feet deep; a channel across Five Mile Bar from 200 to 300 feet wide and from 12 to 15 feet deep; a channel from 200 to 400 feet wide and from 24 to 26 feet deep through the shoal areas at Port Richmond; a channel across Mifflin Bar from 200 to 350 feet wide and from 24 to 25 feet deep; a channel through Schooner Ledge 330 feet wide and 24 feet deep, except over a small area recently discovered, where the depth is reduced to 23 feet at mean low water; a channel through Cherry Island Flats from 200 to 450 feet wide and from 23 to 24 feet deep, and a channel across Bulkhead Shoal from 100 to 370 feet wide and from 24 to 26 feet deep.

The channel between Philadelphia and Camden across Smith Island Bar had been improved by the formation of a dredged cut protected by revetment, so as to give a channel 100 feet wide, with a minimum depth of 6 feet at mean low water.

During the fiscal year ending June 30, 1893, the sum of $83,103.97, which includes the liabilities outstanding June 30, 1892, was expended in surveys, examinations, the repair of the dike at Bulkhead Bar, and dredging at Cherry Island Flats, making a total expenditure since 1836 of $2,163,825.73, of which $811,825.73 has been expended on the present project.

The changes during the past fiscal year are summarized as follows:

The dredged channel across Kinkora Bar has shoaled, the minimum depth at mean low water being now about 7½ feet. At Five-Mile Bar the dike has formed a channel from 12 to 15 feet deep at mean low water and 200 feet wide. At Mifflin Bar the channel has shoaled, the greatest depth being 24.4 feet at mean low water, with a minimum width of 150 feet. At Cherry Island Flats a channel has been dredged 200 feet wide and 26 feet deep at mean low water. At Bulkhead Bar the channel has a depth of 24 feet at mean low water with a least width of 450 feet, and a depth of 26 feet at mean low water, with a least width of 250 feet, and favorable changes are in progress.

During the present year it is proposed to apply available funds to the improvement of the channel at Cherry Island Flats and Schooner Ledge.

July 1, 1892, balance unexpended		$171,278.24
Amount appropriated by act approved July 13, 1892		50,000.00
		221,278.24
June 30, 1893, amount expended during fiscal year		83,103.97
July 1, 1893, balance unexpended		138,174.27
July 1, 1893, outstanding liabilities	$6,570.41	
July 1, 1893, amount covered by uncompleted contracts	8,280.89	
		14,851.30
July 1, 1893, balance available		123,322.97
Amount (estimated) required for completion of existing project		1,475,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix G 1.)

2. Harbor between Philadelphia, Pa., and Camden, N. J.—The islands in the Delaware River between Philadelphia and Camden compel the flood and ebb currents to pursue different paths, narrow the existing channels, and prevent the extension of wharves necessary for the purposes of commerce. The plan of improvement originally adopted by Congress provides for the removal of Smith and Windmill islands and a part of Petty Island, and the formation of a channel of ample depth and about 2,000 feet in width from Kaighn Point to Fishers Point. The project contemplates the advance of wharves and bulkheads on both the Philadelphia and Camden shores during the progress of the work. The excavation is to be done by the General Government. The advance of wharves and bulkheads is under the control of the local authorities and private owners, a portion of the material to be removed by the Government being considered available for the necessary filling. The estimated cost of the work to be done by the United States, exclusive of the cost of the islands, was $3,500,000.

The project was modified by Congress in the sundry civil act approved March 3, 1891, by authorizing a change in the line limiting the excavation on Petty Island, and by requiring that all material removed under appropriations made to that date should be deposited and spread on League Island. The latter requirement was revoked by Congress in the river and harbor act approved July 13, 1892, which provides that the material removed may be deposited in any place or places approved by the engineer officer in charge of the work.

The amount expended under the project to June 30, 1892, was $64,208.56. At that date 2,330 linear feet of revetment had been wholly removed and 923 linear feet partly removed; 322,429 cubic yards of material, scow measurement, had been excavated by dredging and about 35,000 cubic yards by scour, and 287,736 cubic yards was deposited on League Island.

During the fiscal year ending June 30, 1893, 5,495 linear feet of piling and revetment inclosing Windmill Island was removed; 596,108 cubic yards of material, scow measurement, was dredged from Windmill and Petty islands and adjacent shoals, and 327,228 cubic yards was deposited on League Island.

The contract with James A. Mundy & Co. was annulled on December 23, 1892, and on June 1, 1893, a new contract was entered into with the American Dredging Company, of Philadelphia, Pa., for the execution of all the work required for the improvement. Under this contract and at the close of the past fiscal year 112,825 cubic yards of material, scow measurement, had been removed.

During the fiscal year ending June 30, 1894, it is confidently expected that all the revetment will be removed; that at least 3,000,000 cubic yards, scow measurement, will be excavated and deposited, and that at least 700,000 cubic yards will be deposited and spread on League Island.

July 1, 1892, balance unexpended		$635,791.44
Amount appropriated by sundry civil act approved August 5, 1892		41,000.00
Amount appropriated by sundry civil act approved March 3, 1893		500,000.00
		1,176,791.44
June 30, 1893, amount expended during fiscal year		96,325.96
July 1, 1893, balance unexpended		1,080,465.48
July 1, 1893, outstanding liabilities	$16,071.15	
July 1, 1893, amount covered by uncompleted contracts	1,064,394.33	
		1,080,465.48

Amount (estimated) required for completion of existing project	$2,259,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 2.)

3. Schuylkill River, Pennsylvania.—When the work of improvement was commenced in 1870 there was a channel of entrance into the mouth of the river carrying a depth of only 10 feet at mean low water

The original project under which work was commenced in 1870 proposed the formation of a channel 100 feet wide, with a depth of 20 feet from the mouth of the river to Gibson Point, about 4 miles, and a depth of 18 feet from thence to Chestnut Street Bridge, in Philadelphia, about 3 miles.

In 1875 and 1883 this project was amended so as to increase the low-water channel between the mouth and Girard Point, a distance of about 1 mile, to 400 feet wide and 24 feet deep, and from Girard Point to Gibson Point, about 3 miles, to 250 feet wide and 20 feet deep. In 1892 the project was again modified so as to provide for the construction of dikes to maintain a navigable depth at the mouth. The estimated cost of the entire improvement is $529,959.

The amount expended upon this project to June 30, 1892, was $415,031.78. This work had resulted in the formation of a channel about 100 feet wide and from 18 to 20 feet deep at mean low water across the bar at the river's mouth; a channel about 250 feet wide and from 20 to 24 feet deep from inside the bar to Point Breeze, except at Yankee Point, where the width is 300 feet; and from Point Breeze to Gibson Point, a channel from 100 to 200 feet wide and from 18 to 20 feet deep; from thence to Chestnut Street Bridge a channel of navigable width and from 17 to 20 feet deep.

During the fiscal year ending June 30, 1893, two earthen dikes having an aggregate length of 2,797 feet and a pile dike 800 feet in length were constructed at the mouth of the river, at a cost of $16,018.55. After the close of the winter they were repaired and strengthened, at a cost of $262.05. The sum of $17,229.80 was expended in dredging between Girard and Gibson points, where work is still in progress. All the dredging contemplated by the project will be completed under the existing contract, and with funds now available.

The depth of the channel has increased opposite the upper end of the pile dike, but the dike has not been sufficiently extended to produce any decided effect upon the bar. It is proposed to apply available funds to dike construction and to dredging, if found necessary.

July 1, 1892, balance unexpended		$23,718.22
Amount appropriated by act approved July 13, 1892		46,250.00
		69,968.22
June 30, 1893, amount expended during fiscal year		38,752.81
July 1, 1893, balance unexpended		31,215.41
July 1, 1893, outstanding liabilities	$2,176.46	
July 1, 1893, amount covered by uncompleted contracts	14,011.14	
		16,187.60
July 1, 1893, balance available		15,027.81

Amount (estimated) required for completion of existing project	44,959.09
Amount that can be profitably expended in fiscal year ending June 30, 1895	44,959.09
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 3.)

4. Ice harbor at Marcus Hook, Pennsylvania.—This work, in its present plan, was commenced in 1866, the object being to provide a harbor in the Delaware River to protect vessels against moving ice.

In 1785 the Commonwealth of Pennsylvania built, for the convenience of commerce, piers at Marcus Hook, extending from the shore line into the river. It is assumed that at some subsequent time these shore piers were turned over to the United States, since in 1829 an appropriation was made of $5,000 for repairing these piers, improving the harbor, and removing obstructions. No further appropriation was made until 1866.

At this latter date the project was adopted for the construction of detached piers in the harbor, consisting of stone superstructures upon crib foundations filled with stone, together with the deepening of the harbor by dredging.

In 1881 it was proposed to increase the area of the harbor by the construction of a bulkhead about 1,800 feet in length parallel to the shore line and about 150 feet outside of high-water line, and the deepening of this added area by dredging. Nothing was done towards the carrying into effect of the modification of 1881, on account of the objections of some of the abutting property owners, and in 1881 this hitherto proposed modification was abandoned, and an increased depth proposed for the areas protected by the detached piers outside of the natural shore line of the river.

The amount expended from 1866 to June 30, 1892, was $209,000, which was applied to the construction of two landing piers and seven detached ice piers, the deepening by dredging of the protected area, the placing of mooring piles, and the necessary examinations.

During the fiscal year ending June 30, 1893, landing piers were repaired and mooring piles were repaired and replaced, at a cost of $1,067.16.

The piers and mooring piles suffered some injuries from ice and vessels during the past severe winter. The repairs are estimated to cost about $260. The funds now available are sufficient for these and all other anticipated necessities.

July 1, 1892, balance unexpended	$5,000.00
June 30, 1893, amount expended during fiscal year	1,635.62
July 1, 1893, balance unexpended	3,364.38

(See Appendix G 4.)

5. Ice harbor at head of Delaware Bay, Delaware.—The act of August 2, 1882, appropriated $25,000 for the commencement of work on the ice harbor at the head of Delaware Bay, to include the removal of some sunken piers, the remains of an old ice harbor, in the channel east of Reedy Island, Delaware.

The desirability of an ice harbor at the head of Delaware Bay has been long recognized, but until the improvement of the main ship channel shall have been materially advanced, it is believed that appropriations can be applied, with better results to commerce, to the improvement of the channel rather than to the formation of an ice harbor suited to the requirements of the case. As to location, the prevailing judgment would place the ice harbor at or very near Liston Point, but since the works already planned for the improvement of the channel in this part of the river involve the construction of about 11 miles of dikes, the changes which may result from such extensive constructions render the prior location of an ice harbor hazardous.

The amount expended to June 30, 1892, was $8,763.07, of which $3,700 was applied to the removal of the sunken piers back of Reedy Island, as provided in the act of August 2, 1882, making the appropriation of $25,000. The balance was expended in surveys, examinations, preliminary studies, and office expenses.

During the fiscal year ending June 30, 1893, no expenditures were made.

July 1, 1892, balance unexpended	$16,236.93
July 1, 1893, balance unexpended	16,236.93

(See Appendix G 5.)

6. Construction of iron pier in Delaware Bay, near Lewes, Del.—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles surmounted with a timber superstructure. The work was commenced in 1871, and completed, except as to superstructure, in 1880.

The amount expended to June 30, 1890, was $368,453.66, and resulted in the construction of 1,155 linear feet of pier 21 feet in width, and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pier head was about 21 feet at mean low water.

During the fiscal year ending June 30, 1891, $7,033 was expended in replacing about 200 linear feet of the pier destroyed by the collisions of wrecked vessels in 1889, and in placing fender piles along 1,200 linear feet of the shore arm of the pier. The total amount expended in construction, repairs, and inspection was $378,500. During the fiscal year ending June 30, 1892, there were no expenditures on account of this work.

The right to use this pier for railway purposes, granted in the act of July 15, 1870, has never been exercised, and doubtless never will be, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

The timber superstructure is greatly impaired by natural decay, and is in a dangerous condition. It should be thoroughly repaired as a matter of public safety. The cost of this work will not exceed $6,300.

During the ice period of last winter the pier suffered some injuries from ice or vessels. The cluster piles at the pier head were broken and five fender piles were torn out. The repair of these injuries is estimated to cost about $650.

The need of clear regulations governing the use of this pier and the neighboring anchorage under the shelter of the Delaware Breakwater became very apparent last winter during the season of ice and storms, when the harbor was crowded with shipping. Legislation providing for the establishment of such regulations with penalties for their enforcement is recommended.

An appropriation of $860 is recommended, to provide for urgent repairs of unexpected injuries and the supervision and protection of the property and adjacent anchorage.

Amount that can be profitably expended in fiscal year ending June 30, 1895. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	$7,810.00

(See Appendix G 6.)

7. Delaware Breakwater, Delaware.—Under the act of Congress, May 7, 1822, $22,700 was appropriated for a survey of Delaware Bay, near Cape Henlopen, for the purpose of determining upon the site for a harbor of shelter. In 1828 an appropriation of $250,000 was made for commencing the work under a plan submitted by a board of commissioners appointed by Congress.

The project of the board contemplated the construction in the concavity of the bay, just inside Cape Henlopen, of two massive works on the pierres perdues or riprap system, separated by an interval or gap of 1,350 feet, the greater, called the breakwater, to afford safe anchorage during the gales from the north and east; the other, called the ice-breaker, to protect shipping against northwesterly gales and the heavy drifting ice of the bay.

This project was completed in 1869 under aggregate appropriations, including the first for survey, of $2,192,103.70. The stone used in the work amounted to 892,528 gross tons, and varied from one-quarter of a ton to 7 tons in weight, the smaller constituting the bulk of the mass, the larger used to cover the exterior slopes.

As completed in 1869 the breakwater is 2,558 feet long, and the ice-breaker 1,359 feet long on top. The average width on top is 22 feet, and at base 160 feet. The top is from 12 to 14 feet above mean low water.

In 1882 a project was adopted for closing the gap between the breakwater and the ice-breaker by means of a random stone foundation with a concrete superstructure. The random stone foundation was to be brought to a height of 12 feet below low water with a width on top of 48 feet; the concrete superstructure to have a width on bottom of 24 feet, rising to a height of 12 feet above mean low water, with a width on top of 12 feet. The estimated cost of this project was $675,000.

In 1883 and 1884 the project was modified by providing a foundation of brush mattresses for the random stone superstructure and omitting the construction of a pile bridge across the gap, which formed part of the project of 1882 for closing the gap.

In 1890 the concrete superstructure was further modified by establishing its base at 15 feet below low water by making it rectangular in section, with a width of 27 feet and height of 27 feet, and by constructing the work to above the plane of high water of large concrete blocks, above which concrete in mass was to be used. The estimated cost of the modified project, including the $356,250 appropriated from 1882 to 1888, was $856,250.

In 1891, the random stone substructure having been practically completed to an average level of 15 feet below low water, the project for the hitherto proposed concrete superstructure was modified by substitution of random stone for the remaining part of the work, so as to raise the structure to a height of 14 feet above mean low water, with a width on top of 20 feet, the width at low water to be 40 feet, and the slopes below this plane to be such as may be formed by the action of the sea; between low water and the top the slopes to be about 1 on 0.7, formed by heavy stones laid in position. The estimated cost of completing this part of the work is $270,000, or, including the $486,250 appropriated from 1882 to 1892, the cost of closing the gap is $756,250.

From the beginning of the work in 1822 to June 30, 1892, the total amount expended was $2,627,367.87; of which $435,264.17 was expended on the existing project for closing the gap, the substructure having been thereby raised to the level of mean low water over a length of 1,006 feet.

During the fiscal year ending June 30, 1893, the sum of $50,823.39 was expended in raising the substructure to low water over its full length. The gap is now completely closed to the level of mean low water.

Should funds become available, it is proposed to apply them to the construction of the superstructure, and the strengthening of the slopes if necessary.

The increase in the dimensions of vessels since the present harbor was designed in 1822, and the shoaling which has ensued behind the breakwater, render the harbor in its present condition inadequate to the requirements of commerce. Upon the completion of the present project of closing the gap, additional anchorage area will be added to the harbor, and it is probable that the shoaling will cease and the anchorage be deepened.

Under favorable conditions the work can be completed in a single working season. Its immediate completion is urgently necessary, since the substructure in its present condition is a serious danger to navigation, being invisible at the higher stages of the tide. One vessel has been totally wrecked upon it, and several others have been severely injured. It has been found impossible to mark it in such a way as to insure the safety of coasting vessels. The appropriation of the whole amount necessary for the completion of the work is therefore recommended.

July 1, 1892, balance unexpended	$985.83
Amount appropriated by act approved July 13, 1892	50,000.00
	50,985.83
June 30, 1893, amount expended during fiscal year	50,823.39
July 1, 1893, balance unexpended	162.44

Amount (estimated) required for completion of existing project	270,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	270,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 7.)

8. *Rancocas River, New Jersey.*—In its original condition Rancocas River carried a minimum low-water depth of 4½ feet between the mouth and Centerton, a distance of about 7½ miles, and from Centerton to Mount Holly, a distance of about 5½ miles, a ruling depth of about 2½ feet.

The original project of 1881 proposed the formation, by a dike at Coat's Bar and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton, and from thence to Mount Holly a channel 5 feet deep.

Operations were carried on under this project from 1881 to 1892, under appropriations aggregating $30,000, made in 1881, 1882, and 1890. To the close of the fiscal year ending June 30, 1892, $29,899.91 had been expended in the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton, and 25 feet wide and 4 feet deep from Centerton to Mount Holly, and in the removal of three wrecks.

During the fiscal year ending June 30, 1893, $4,845.22 was expended in the formation of a low-water channel 50 feet wide and 5 feet deep above Centerton for a distance of about three-fourths of a mile.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	4,845.22
July 1, 1893, balance unexpended	154.78
Amount (estimated) required for completion of existing project	46,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 8.)

9. Alloway Creek, New Jersey.—In its original condition Alloway Creek was obstructed between its mouth and Quinton, a distance of about 10½ miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to about 4 feet.

The original project of 1889 proposed the formation, by dredging, of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above the Upper Hancock Bridge; from thence a channel of the same depth and 75 feet wide to a locality known as the Square, where the work is to be supplemented by a dike. At a locality known as the Canal, in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines.

Up to the close of the fiscal year ending June 30, 1892, $5,599.61 had been expended in dredging at the Canal, Square, and Upper Hancock Bridge, whereby channels from 40 to 75 feet wide and 6 feet deep at mean low water were formed through the worst bars.

During the fiscal year ending June 30, 1893, $3,221.39 was expended in dredging the channels.

July 1, 1892, balance unexpended	$400.39
Amount appropriated by act approved July 13, 1892	3,000.00
	3,400.39
June 30, 1893, amount expended during fiscal year	3,221.39
July 1, 1893, balance unexpended	179.00
Amount (estimated) required for completion of existing project	16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	16,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G 9.)

10. Salem River, New Jersey.—In 1872 the upper part of this river was separated from the lower part by a dam and connected with the Delaware River by a canal. Thus two independent streams were formed.

In its original condition the channel of the Upper Salem River carried about 3 feet at mean low water over the bar, from 5 to 11 feet through the canal, and about 3 feet to Hoxie's Bridge.

The original project for its improvement was adopted in 1881. It provided for the removal of a shoal near Biddle's Landing at an estimated cost of $4,500. The work done in 1881 and 1882 resulted in the formation of a channel 60 feet wide and from 6 to 7 feet deep at mean low water from the head of the canal to a point about 200 feet above Biddle's Landing, leaving about 700 feet to be improved. On account of shoaling, it was then estimated that the completion of the improvement would cost from $4,000 to $6,000.

No work has been in progress since 1882, until the past fiscal year.

The amount expended upon this project to June 30, 1892, was $3,009.34.

During the fiscal year a survey was made which shows that there has been extensive shoaling in the channel since 1882.

Work has not yet been commenced under the existing contract for dredging in the channel between the head of the canal and Hoxie's Landing.

It is believed that the improvement will be temporary.

Amount appropriated by act approved July 13, 1892	$2,500.00
June 30, 1893, amount expended during fiscal year	103.59
July 1, 1893, balance unexpended	2,396.41
July 1, 1893, amount covered by uncompleted contracts	1,950.00
July 1, 1893, balance available	446.41
Amount (estimated) required for completion of existing project	1,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,700.00

(See Appendix G 10.)

11. Goshen Creek, New Jersey.—In its original condition, Goshen Creek carried a low-water depth of from 2 to 4 feet, with a least low-water width of 20 feet and a high-water width of 36 feet from Goshen to a point about 4,000 feet below; and from thence to the mouth, a distance of about 2,500 feet, a low-water depth of from 3 to 5 feet with a least width of 30 feet.

The project for its improvement, adopted in 1891, proposed the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing to a low-water depth of 3 feet and a width of 30 feet; the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth to the limit of the sand beyond the low-water line, and the protection of the channel by a sheet-pile jetty.

The improvement was commenced during the fiscal year ending June 30, 1893, and $2,770.16 was expended in widening and deepening the channel to the proposed dimensions over a distance of about 3,975 feet below Goshen Landing. By this work about one-fourth of the projected improvement has been completed, and the navigable conditions have been proportionately improved.

Amount appropriated by act approved July 13, 1892	$3,000.00
June 30, 1893, amount expended during fiscal year	2,770.16
July 1, 1893, balance unexpended	229.84
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	9,000.00

(See Appendix G 11.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the following wrecks were removed under the provisions of the act of July 14, 1880: The iron steamship *Gaudaloup*, and the tug *Starlight*, from the channel at Barnegat Inlet, New Jersey; the side-wheel steamship *Florida*, from off the coast of New Jersey, about 1¾ miles from the excursion house at Atlantic City; the sailing ship *Geestemunde*, from off the coast of New Jersey, about 3 miles south of Absecon Inlet; the schooner *Marcia S. Lewis*, from the

entrance to Great Egg Harbor Inlet, New Jersey; the schooner *Annie S. Gaskill* and barge *McClellan*, from off the entrance to Delaware Bay. (See Appendix G 12.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. C. W. Raymond, Corps of Engineers, and reports thereon submitted through the division engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Barnegat Inlet, entrance and harbor, New Jersey.—Maj. Raymond submitted report of examination under date of August 13, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 16, Fifty-second Congress, second session. (See also Appendix G 13.)

2. Dennis Creek, New Jersey.—Maj. Raymond submitted report of examination under date of July 29, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the creek is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $250. The report was transmitted to Congress and printed as House Ex. Doc. No. 46, Fifty-second Congress, second session. (See also Appendix G 14.)

3. Cooper Creek, New Jersey.—Maj. Raymond submitted report of examination under date of August 13, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the creek is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $300. The report was transmitted to Congress and printed as House Ex. Doc. No. 81, Fifty-second Congress, second session. (See also Appendix G 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN DELAWARE AND IN MARYLAND AND VIRGINIA EAST OF CHESAPEAKE BAY.

This district was in the charge of William F. Smith, United States agent, major of engineers, U. S. Army, retired; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Wilmington Harbor, Delaware.—Previous to 1836, when the first appropriation for the improvement of Christiana River was made, the depth of water at the entrance was about 8½ feet. The minimum depth in the channel of the portion of the river below Third Street Bridge was 8 feet. This depth was increased by dredging in that year to 10 feet. Under a project commenced in 1871 and completed in 1881, a 12-foot channel from 100 to 200 feet wide was made from the mouth to above the city of Wilmington. The present project was adopted in 1881 and is for a 15-foot low-water channel from the mouth of the river to the Pulp Works, with a width of 150 feet from the mouth to the Rolling Mill Wharf; 100 feet to the Delaware and Western Railroad Bridge; and 75 feet to the Pulp Works. The project included further, a channel 12 feet deep and 50 feet wide from the latter works to the Delaware Railroad Bridge and construction of a jetty on the north side of the mouth of the river. Dredging operations and the con-

struction of the jetty were begun in the following year. The original estimate was $175,551 which was increased in 1883 to $191,384 by changing the width of the proposed channel to 150 feet throughout. In 1884 the project was amended by raising the height of the jetty 4 feet; an extension of 322 feet to the jetty as then built was also proposed and approved, but has not yet been carried out.

Up to the close of the fiscal year ending June 30, 1892, the sum of $201,404.66 had been expended under this project. There was then an improved channel 15 feet deep at low water and 150 feet wide between the mouth and the ship railway at the Pusey & Jones shipyard.

During the past fiscal year operations were carried on under the appropriation made July 13, 1892, and the channel, as approved, was extended from the Pusey & Jones shipyard to within 75 feet of Market Street Bridge, and one of the ledges of rock near Third Street Bridge was removed to the required depth. Under a supplementary contract the bar at the mouth of the river was also dredged, having shoaled considerably during the past four years. The total number of cubic yards of material removed under the dredging contracts was 72,986, and under the contract for removal of rock, 467.

With exception of a ledge of rock just below Third Street Bridge, over which there is 12 feet of water, and for the removal of which to 15 feet a contract has been made, the channel in the river is now completed in accordance with the project from the Delaware River to Market Street Bridge.

July 1, 1892, balance unexpended	$2,345.34
Amount appropriated by act approved July 13, 1892	40,000.00
	42,345.34
June 30, 1893, amount expended during fiscal year	14,435.55
July 1, 1893, balance unexpended	27,909.79
July 1, 1893, amount covered by uncompleted contracts	27,909.79
Amount (estimated) required for completion of existing project	47,634.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	47,634.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 1.)

2. Ice harbor at New Castle, Del.—This ice harbor is one of the oldest in the Delaware River, its construction for the protection of vessels against floating ice having been commenced during colonial times. Since the beginning of the present century, its improvement has been carried on by the General Government at various intervals, the total amount expended up to the close of the fiscal year ending June 30, 1892, being $234,937.14.

Nothing was done during the past fiscal year. The existing project, as far as it relates to the construction of ice piers, is completed. The harbor in its present condition affords the best shelter on the Delaware River for deep-draft vessels in winter, and the necessity for increasing the protected area is already apparent.

July 1, 1892, balance unexpended	$3,846.80
June 30, 1893, amount expended during fiscal year	* 263.80
July 1, 1893, balance unexpended	3,583.00

(See Appendix H 2.)

3. Appoquinimink River, Delaware.—This stream is a tidal tributary of Delaware Bay, flowing through New Castle County, Del. It is navigable for about 10 miles for vessels of light draft. A bar having only 1½ feet of water over it at low tide obstructs the mouth of the river seriously during that stage of the tide. The average rise and fall of the tide is 6 feet at the mouth and 3.2 feet at Odessa, the head of navigation.

The project for improvement proposed in a report on a survey of the river made in 1889 and adopted under an appropriation made by the river and harbor act approved September 19, 1890, provides for dredging a channel 8 feet deep at mean low water with a width of 100 feet from the mouth to New Bridge, near Townsend's Wharf, and thence 80 feet wide to the county bridge at Odessa, the estimated cost of the improvement being $39,963. At the close of the fiscal year ending June 30, 1892, the sum of $4,963.72 had been expended by dredging in the upper river, resulting in a greatly increased harbor space at the town of Odessa.

During the past fiscal year an additional length of 4,487 feet of channel was improved, extending it to a point 6,762 feet below Odessa Bridge.

July 1, 1892, balance unexpended	$36.28
Amount appropriated by act approved July 13, 1892	5,000.00
	5,036.28
June 30, 1893, amount expended during fiscal year	5,036.28
Amount (estimated) required for completion of existing project	29,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 3.)

4. Smyrna River, Delaware.—This river, formally called Duck Creek, had, before improvements began in 1879, a minimum depth of 2½ feet within the river and about 4 feet over the bar at the mouth. Navigation was possible only at high tide, and was carried on by one steamer and seven small schooners.

In 1878 a project was made for the improvement of the whole river, including a plan for deepening the channel across the bar at the mouth. By special direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel across this obstruction 100 feet wide and 8 feet deep at mean low water. The dredged channel soon filled up again.

A new project was submitted in 1887 for a 7-foot low-water channel, 60 feet wide inside the river and 100 feet at the bar, the channel at the latter point to be protected on each side by stone jetties. The estimated cost of this project is $90,698.40. The portion of the project relating to dredging has been adopted.

At the close of the fiscal year ending June 30, 1892, the sum of $17,143.96 had been expended in dredging inside the river. At that date a channel had been dredged 40 feet wide and 6½ feet deep, at mean low water, between Smyrna Landing, the head of navigation, and Eagle Nest Landing, about 5 miles below. The channel made has been of great benefit to navigation and has facilitated expeditious and regular transportation, which heretofore was impossible.

A contract for the available funds has been made and it is expected that the proposed work will be completed during the year 1893.

July 1, 1892, balance unexpended	$89.67
Amount appropriated by act approved July 13, 1892	3,000.00
	3,089.67
June 30, 1893, amount expended during fiscal year	40.49
July 1, 1893, balance unexpended	3,049.18
July 1, 1893, amount covered by uncompleted contracts	3,049.18
Amount (estimated) required for completion of existing project	19,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 4.)

5. Murderkill River, Delaware.—This river is a tidal stream and a tributary of Delaware Bay, and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river is fair, for the greater part of its length the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, exists a serious obstruction, the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 3.83 feet.

The project for improvement, proposed in a report on a survey made in 1891, provides for a channel 7 feet in depth at mean low water, 80 feet in width from Frederica, which is at the head of navigation, to the mouth of the river, and 250 feet in width on top and 150 feet in width at the base to the 7-foot depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side to a height of at least 2 feet above high spring tides, the estimated cost being $47,550.

An appropriation of $7,000 was made by the river and harbor act approved July 13, 1892, for this improvement.

A contract has been made for dredging a cut 60 feet wide and 5 feet deep along the line of the proposed channel at the mouth, and on June 28, 1893, operations were begun. At the close of the fiscal year 220 feet of the cut had been dredged and 2,350 cubic yards of materials had been removed.

Amount appropriated by act approved July 13, 1892	$7,000.00
June 30, 1893, amount expended during fiscal year	152.90
July 1, 1893, balance unexpended	6,847.10
July 1, 1893, amount covered by uncompleted contracts	6,847.10
Amount (estimated) required for completion of existing project	40,550.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 5.)

6. Mispillion River, Delaware.—This river is a tributary of Delaware Bay and enters the latter about 17 miles northwest of Cape Henlopen. It is navigable for about 12 miles, as far as Milford, a thriving town with shipyards and numerous factories. The mouth of the river is greatly obstructed by a flat fore shore without a channel. Vessels can only enter and depart at high water which rises on an average 4 feet.

The river from Milford to the mouth has been improved by the General Government between the years 1879 and 1889, and $17,000 has been expended in making a channel 40 feet wide and 6 feet deep at mean low water.

The project for improvements at the mouth of the river, proposed in a report on a survey made in 1891, provides for a cut across the flats in a southeasterly direction, having a width of 150 feet and a depth of 6 feet at mean low water, beginning opposite the light-house and ending in deep water in the bay; the cut to be protected on the upper or north side by a bank made of excavated material. The estimated cost is $24,000.

An appropriation of $12,000 for this work was made by the river and harbor act approved July 13, 1892.

During the past fiscal year a contract has been made for dredging about 80 feet in width of the proposed cut. Dredging was begun in May, but owing to the strong currents inside the mouth of the river and the live condition of the dredged material the contractor was unable to maintain a proper depth in the cut made, and the department authorizes a temporary suspension of work until some protective works could be built. Six thousand eight hundred and twenty-nine cubic yards of material was removed in the attempt to begin the cut.

Amount appropriated by act approved July 13, 1892		$12,000.00
June 30, 1893, amount expended during fiscal year		1,089.38
July 1, 1893, balance unexpended		10,910.62
July 1, 1893, outstanding liabilities	$80.49	
July 1, 1893, amount covered by uncompleted contracts	5,201.00	
		5,281.49
July 1, 1893, balance available		5,629.13

Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 6.)

7. *Broadkiln River, Delaware.*—In its original condition the depth of water in the river was from 3 to 4 feet at the numerous shoals which impeded navigation. The depth at the entrance was and still is from 1½ to 2 feet at low water.

A project for a 6-foot low-water channel inside the river from Milton to the mouth and for a new entrance across Lewes Cape was submitted in 1871, the cost being estimated at $80,447. This estimate was reduced in 1881 by a revised project to $51,450. At the close of the fiscal year ending June 30, 1892, $35,000 had been expended, and the channel inside the river was completed. After entering vessels are now no longer detained by the shoals at low tide and proceed directly to their destination. Whilst the results are of great benefit to the existing shipping it is not apparent that the latter has increased to any appreciable extent. Nothing was done during the past fiscal year.

Amount (estimated) required for completion of existing project	$21,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix H 7.)

8. *Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.*—This improvement is made with a view of forming an inland navigation route about 75 miles in length, beginning in Chincoteague Bay and following generally deep water in Synepuxent, Isle of Wight, and Big and Little Assawaman bays; thence across the country for about 4 miles from Little Assawaman Bay to Indian River Bay; thence across the latter into and up Reho-

both Bay; thence from the head of Rehoboth Bay for about 8 miles across Lewes and Rehoboth Hundred into Delaware Bay at the Delaware Breakwater Harbor. The project adopted in 1886 contemplated a dead level tidal canal 70 feet wide at bottom, the depth to be made to 6 feet below the mean low-water level in the Delaware Breakwater Harbor, at an estimated cost of $350,000. This project was modified in 1892 as far as it relates to the section of the waterway situated between Rehoboth Bay and Delaware Bay in reducing the width at the bottom to 20 feet.

Up to the close of the fiscal year ending June 30, 1892, $67,932.87 had been expended. Little Assawaman and Indian River bays had been connected by a cut 20 feet wide and 4 feet deep, over which three temporary wooden bridges, provided with draws, were constructed. The location of the line of the canal across the mainland between Rehoboth Bay and Delaware Bay had also been approved after the extensive surveys had been made and proceedings to obtain the necessary land were in progress.

During the past fiscal year the appropriations of $50,000 and $25,000, made September 19, 1890, and July 13, 1892, respectively, were made available, the requirements of the law having been complied with, the State of Delaware giving the right of way for the canal to the United States free of cost to the latter.

A project for the expenditure of the available funds was submitted in January, 1893, which was approved. Twice the proposed work has been advertised, but as the bids received were considered unsatisfactory or too high they were all rejected and new bids were invited at the close of the fiscal year.

The portion of the waterway already excavated is in a fair condition, and is used by small vessels trading between Chincoteague Bay and Rehoboth Bay. As there is yet no safe outlet at the upper end of the route, the commerce just developing is still limited.

July 1, 1892, balance unexpended	$50,817.13
Amount appropriated by act approved July 13, 1892	25,000.00
	75,817.13
June 30, 1893, amount expended during fiscal year	1,249.13
July 1, 1893, balance unexpended	74,568.00
Amount (estimated) required for completion of existing project	206,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 8.)

9. Susquehanna River above and below Havre de Grace, Md.—Before improvements were begun in this section of the river the least depth of water over the shoals between Havre de Grace and Spesutia Island was 5 feet at low water. The channel between Watson Island, above Havre de Grace, and the shoal running out from the west shore was narrow, and was believed to be one of the causes of ice gorges at and near Port Deposit.

Improvements have been in progress since 1852. The present general project is for a 15-foot low-water channel below Havre de Grace and for the removal of the shoal opposite Watson Island to a depth of 8 feet below mean low water.

The channel below Havre de Grace was dredged the last time in 1885. It has shoaled again. The channel at Watson Island has been

widened about 400 feet, but the shoal which was removed has nearly entirely reformed since the discontinuance of the work in 1889. At the close of the fiscal year ending June 30, 1892, $158,687.65 had been expended in these improvements.

There were no operations during the fiscal year ending June 30, 1893. A report on the survey of the river in this locality was submitted December 26, 1891, with estimates for a new project. (See Annual Report, Chief of Engineers, 1892, pages 996–998.)

July 1, 1892, balance unexpended	$4,094.69
Amount appropriated by act approved July 13, 1892	4,000.00
	8,094.69
June 30, 1893, amount expended during fiscal year	56.32
July 1, 1893, balance unexpended	8,038.37
Amount (estimated) required for annual dredging	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 9.)

10. Northeast River, Maryland.—This river is a small tributary of Chesapeake Bay and joins the latter at the head of the bay, a few miles east of the Susquehanna River. Its tidal portion is in Cecil County, Md., and is broad and shallow and about 5 miles long, the town of Northeast being at the head of navigation. The average rise of the tide is 2¼ feet. The river is obstructed by a bar about three-fourths of a mile below the town. The original depth of water on the bar was 18 inches at low tide.

In 1873 and 1881 a channel was dredged under appropriations aggregating $15,500 from outside the bar to the wharves. The depth made was 6 feet at mean low water. Subsequently certain portions of the channel filled in again, reducing the depth to 4 feet.

The present project for improvement, adopted in 1890, provides for a channel 6 feet deep at low water, having a width of 75 feet across the bar and a width of 60 feet inside the bar as far as Davis Wharf, at Northeast, at an estimated cost of $5,140. At the close of the fiscal year ending June 30, 1892, $17,938.37 had been expended in the improvement of this river—$2,438.37 under the present project. On that date a channel existed across the bar 5,700 feet long, 40 feet wide, and about 6 feet deep, ending in deep water opposite Stony Run, but in the lower portion gave signs of shoaling again.

During the fiscal year ending June 30, 1893, the channel was widened and deepened as proposed and the project was completed.

There is no appreciable increase in the limited commerce of the river, and nothing further is recommended.

July 1, 1892, balance unexpended	$61.63
Amount appropriated by act approved July 13, 1892	2,640.00
	2,701.63
June 30, 1893, amount expended during fiscal year	2,701.63

(See Appendix H 10.)

11. Elk River, Maryland.—This river is a tributary of Chesapeake Bay and is navigable for 17 miles as far as the town of Elkton, in Cecil County, where the average rise of tide is 2½ feet. Before improvements were begun in 1873 the least depth in the channel was 1¼ feet.

In 1884 a project, giving a channel 80 feet wide over the bar at

Cedar Point, 3 miles below Elkton, and 70 feet wide from Cedar Point to the county bridge in the town, with a general depth of 7 feet at mean low water, was completed at an expense of $31,500. The channel near the bridge soon filled in again, reducing the depth to about 5 feet at low water.

The present project for improvement, adopted in 1890, provides for an 8-foot low-water channel 100 feet wide from the lower county bridge at Elkton to the clubhouse opposite Cedar Point, a distance of about 2 miles, at an estimated cost of $24,000. At the close of the fiscal year ending June 30, 1892, $8,904.23 had been expended, completing the channel for a length of 3,800 feet below the bridge.

During the past fiscal year this section, which had shoaled again, was redredged and the remaining length of the proposed channel was improved to the lower terminus at Cedar Point, thereby completing the project.

Nothing further is recommended.

July 1, 1892, balance unexpended	$1,095.77
Amount appropriated by act approved July 13, 1892	5,000.00
	6,095.77
June 30, 1893, amount expended during fiscal year	2,599.83
July 1, 1893, balance unexpended	3,495.94
July 1, 1893, outstanding liabilities	2,980.48
July 1, 1893, balance available	515.46
Amount (estimated) required for completion of existing project	9,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix H 11.)

12. Fairlee Creek, Maryland.—The original depth at the mouth before improvements were begun was 2 feet at low tide. Within the creek it was about 5 feet. Navigation was, and still is, carried on by a few flat-bottomed so-called lime boats and by one small schooner.

The existing project is for a 7-foot low-water channel, 100 feet wide, from deep water in Chesapeake Bay to a point about 3 miles above the mouth of the creek, the estimated cost being $15,558.

Up to the close of the fiscal year ending June 30, 1893, $10,000 had been expended and the channel, as proposed, from deep water in the bay to the mouth had been completed and a portion of the channel inside the creek had been dredged to the required depth for a distance of 4,738 feet and for a width of 50 feet.

No appropriation was made for this creek in the last river and harbor act and there were, consequently, no operations during the fiscal year ending June 30, 1893. There are as yet no indications that the very limited commerce of the creek is increasing.

July 1, 1892, balance unexpended	$22.47
June 30, 1893, amount expended during fiscal year	22.47
Amount (estimated) required for completion of existing project	5,558.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,558.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 12.)

13. Chester River, Maryland, from Crumpton to Jones Landing.—This river is a tidal stream 40 miles long, forming the boundary line between Kent and Queen Anne counties, Eastern Shore of Maryland, and flows

into Chesapeake Bay. It is navigable for vessels drawing 6 feet of water at low tide as far as Crumpton, about 33 miles above the mouth. The least depth of water within the last 7 miles of the river is 3 feet. At Crumpton the average rise of the tide is 2.1 feet. A short distance from this town several shoals have previously been improved by the United States.

The existing project for improvement is for a 6-foot low-water channel 60 feet wide from Crumpton to Jones Landing, a distance of 6¼ miles, at an estimated cost of $12,750.

Up to the close of the fiscal year ending June 30, 1892, $3,088.58 had been expended, resulting in improving the existing channel for about 4 miles above Crumpton, by dredging a number of shoals which obstructed the channel.

During the past fiscal year the channel was dredged for an additional length of 3,083 feet, and about 1½ miles of the river remains to be dredged. A number of sailboats carrying grain and other farm products have commenced to make regular trips from the head of the improved channel.

July 1, 1892, balance unexpended	$1,903.77
Amount appropriated by act approved July 13, 1892	3,000.00
	4,903.77
June 30, 1893, amount expended during fiscal year	4,861.77
July 1, 1893, balance unexpended	42.00
Amount (estimated) required for completion of existing project	4,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	4,750.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 13.)

14. Choptank River, Maryland.—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet at low water. Navigation, carried on by small sailing vessels, extended only to 3 miles above Denton; upon the remaining 5 miles, to Greensboro, all freight had to be transported upon scows.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, the estimated cost being $79,000. The project was adopted the same year. Since that time the channel has been dredged at various points to depths of 6, 7, and 8 feet, and for a width of 40 feet only. Up to the close of the fiscal year ending June 30, 1892, $37,795.28 had been expended between Denton and Greensboro, resulting in a continuous channel not less than 40 feet wide and over 5 feet deep, except a section 1¾ miles in length, which had previously been dredged to 5 feet only.

During the past fiscal year $10,204.72 was expended. The channel was widened to the approved width of 75 feet, beginning at Greensboro and ending near the Brick Mills, a distance of about 4 miles. At such points where the existing depth was less than 8 feet the dredging was done to 7½ feet at mean low water. The dredged channel shows no signs of deterioration. During the past six years a steamboat has run regularly between Baltimore and Greensboro.

July 1, 1892, balance unexpended	$7,204.72
Amount appropriated by act approved July 13, 1892	3,000.00
	10,204.72
June 30, 1893, amount expended during fiscal year	10,204.72

Amount (estimated) required for completion of existing project	$20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 14.)

15. La Trappe River, Maryland.—This river, formerly called Dividing Creek, is in Talbot County, Eastern Shore of Maryland, and flows into the Choptank River, one of the larger tributaries of Chesapeake Bay. It is about 3 miles long, and has no fresh-water inflow at the head, and was originally only 4 feet deep. The entrance to the river was seriously obstructed by several shoal bars, with a least depth of 9 feet in the narrow channel, which was very tortuous and about one-half of a mile long. The average rise of the tide is 1.5 feet.

Previous to the adoption of the present project the sum of $5,333.50, raised by private subscription, had been expended in dredging at the head of the river and at the bar at the mouth. The average depth in the river was thereby increased to 8 feet and the channel at the mouth was somewhat widened.

The present project for improvement, which was proposed in a report on a survey made in 1891, provides for a channel 150 feet wide and 11 feet deep across the bar at the mouth and for a channel 75 feet wide and 8 feet deep at mean low water inside the river as far as Trappe Landing, situated at the head of navigation. The estimated cost is $7,250.

An appropriation of $2,500 was made for this work by the river and harbor act approved July 13, 1892.

During the fiscal year ending June 30, 1893, the channel across the bar at the mouth of the river was dredged under the first appropriation made, resulting in increasing its width to 100 feet and its depth to 11 feet at mean low water. This channel is of great benefit to the steamers, which generally enter and leave the river during the night-time.

Amount appropriated by act approved July 13, 1892	$2,500.00
June 30, 1893, amount expended during fiscal year	2,496.30
July 1, 1893, balance unexpended	3.70

Amount (estimated) required for completion of existing project	4,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	4,750.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 15.)

16. Warwick River, Maryland.—This river, formerly named Secretary Creek, is in Dorchester County, Eastern Shore of Maryland, and flows into the Choptank River, one of the large tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh water influx at the head, and was originally only 4 feet deep. The average rise of tide is 1.7 feet.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river, $6,000 by the General Government and the remaining amount by private parties.

The present project for improvement, which was proposed in a report on a survey made in 1891, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing at the head of the river, at an estimated cost of $18,600.

An appropriation of $6,000 for this work was made by the river and harbor act approved July 13, 1892.

During the fiscal year ending June 30, 1893, 4,400 feet of the channel, as approved, was completed, beginning in the Choptank River outside the mouth of the river, and part of the turning basin at Secretary Landing was deepened to 10 feet. The obstructions at the entrance, which formerly seriously impeded navigation during low tides and high northwesterly winds, are now removed, but the channel inside the river remains to be improved.

Amount appropriated by act approved July 13, 1892	$6,000.00
June 30, 1893, amount expended during fiscal year	5,991.23
July 1, 1893, balance unexpended	8.77
Amount (estimated) required for completion of existing project	12,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 16.)

17. Cambridge Harbor, Maryland.—The entrance to this harbor had originally a depth of water of only 4½ feet at low tide. Within the harbor the depth was about 3 feet upon an average. During strong northwesterly winds vessels drawing over 3 feet of water could not cross the bar. The local commerce was carried on by a limited number of small sailing vessels and one steamer of light draft.

Previous to 1871 the citizens of Cambridge expended $7,500 in dredging the harbor. In that year the General Government began improvements under a project completed in 1879, resulting in a channel 100 feet wide across the bar 8 feet in depth, certain portions of the inner harbor being dredged to the same depth at the same time. The amount expended under this project was $32,500.

A new project, based upon a survey made in 1887, was adopted in 1888, providing for a channel 12 feet deep at low water, having a width of 150 feet from the Choptank River to the railroad wharf, and for dredging the inner harbor to a depth of 10 feet below and of 8 feet above the bridge, at an estimated cost of $17,736.60. At the close of the fiscal year ending June 30, 1892, $4,927.44 had been expended, resulting in a channel 12 feet deep, having a width of 88 feet at the bar at the entrance and 22 feet inside the harbor as far as the railroad wharf.

During the fiscal year ending June 30, 1893, a portion of the available funds was expended in completing the 12-foot channel as proposed and in dredging the area of the inner harbor below the bridge to a depth of 10 feet at mean low water. Operations were still in progress at the close of the fiscal year and will soon be completed.

The harbor above the bridge will be dredged as soon as the width of the draw in the bridge is increased as required by law, and as the available funds are sufficient to complete the project nothing further is recommended.

July 1, 1892, balance unexpended		$5,072.56
Amount appropriated by act approved July 13, 1892		7,737.00
		12,809.56
June 30, 1893, amount expended during fiscal year		1,101.45
July 1, 1893, balance unexpended		11,708.11
July 1, 1893, outstanding liabilities	$75.00	
July 1, 1893, amount covered by uncompleted contracts	4,503.62	
		4,578.62
July 1, 1893, balance available		7,129.49

(See Appendix H 17.)

18. Broad Creek River, Delaware.—This river is a tidal stream and a tributary of the east fork of the Nanticoke River, which flows into the Chesapeake Bay. It is wholly in the western portion of Sussex County, Delaware, its navigable length being about 7 miles; Laurel, a growing manufacturing town, is at the head of navigation.

Broad Creek River, then simply named Broad Creek, has previously been improved by the General Government. Before improvements were commenced in 1881 the low-water depth at Laurel was 2 feet, below the town it was in some places only 1½ feet. At the close of the year 1889, when the original project was completed, a channel 6 feet deep at mean low water and 50 feet wide had been dredged from Bethel to Laurel, a distance of nearly 3 miles, and contributed towards raising Laurel to the front rank of shipping points on the peninsula. The cost of these improvements was $35,000, but the rapidly increasing commerce on the river demanded an enlargement of the channel.

The project for improvement proposed in a report upon an examination made to comply with requirements of the river and harbor act approved September 19, 1890, provides for dredging a channel 70 feet wide and 8 feet deep at mean low water from Bethel to the head of navigation at Laurel, at an estimated cost of $15,000.

An appropriation of $5,000 for this work was made by the river and harbor act approved July 13, 1892.

During the past fiscal year 6,455 feet of the channel as approved has been completed above Bethel, and navigation at several sharp turns in this section of the river was thereby much facilitated.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	4,900.45
July 1, 1893, balance unexpended	99.55

Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 18.)

19. Wicomico River, Maryland.—The original depth in the river near Salisbury, at the head of navigation, did not exceed 18 inches before improvements were begun in 1872. Under the project made that year, and completed in 1885, $50,000 was expended, resulting in a channel 7 feet deep at mean low water and from 75 to 100 feet wide at and just below Salisbury.

The present project for improvement, necessitated by the increased business of the port, was submitted in a report upon a survey of the river made in 1889, and was adopted in 1890. It provides for a channel 9 feet deep at mean low water and 100 feet wide from near Fruitland Wharf to the drawbridge at Salisbury, a distance of nearly 2 miles, at an estimated cost of $23,200.

Up to the close of the fiscal year ending June 30, 1892, $10,188.10 had been expended and a cut about 30 feet wide and 9 feet deep had been dredged for a distance of 9,250 feet, which was of great benefit to the larger schooners which enter the river.

Nothing was done during the past fiscal year. A contract, to be completed by May 30, 1894, has been made for the expenditure of the available funds.

July 1, 1892, balance unexpended	$768.96
Amount appropriated by act approved July 13, 1892	6,500.00
	7,268.96
June 30, 1893, amount expended during fiscal year	206.89
July 1, 1893, balance unexpended	7,062.07
July 1, 1893, amount covered by uncompleted contracts	7,062.07
Amount (estimated) required for completion of existing project	6,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,700.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 19.)

20. Manokin River, Maryland.—Before improvements were commenced in 1891, the depth of water at the mouth of the river, at the so-called "Mud Flats," was between 1 and 2 feet at low tide. These flats are nearly 3 miles wide, and made navigation, except at high water, impossible, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of the tide at the flats is 2.6 feet.

The adopted project for improvement is for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharp Point, embracing the section called the "Mud Flats," at an estimated cost of $30,000.

Up to the close of the fiscal year ending June 30, 1892, $7,370.92 had been expended and the proposed cut across the mud flats had been made for a width of 30 feet and to a depth of 5 feet at low tide, which opened the river for navigation during low tide.

During the past fiscal year an additional cut, 30 feet wide, was dredged, adjoining the first cut at the mud flats, and this cut and portions of the old cut which had shoaled were made 6 feet deep at mean low water. Several sharp points in the upper river, above Sharp Point, were also removed and navigation upon the whole river at low tide was thereby greatly facilitated.

July 1, 1892, balance unexpended	$129.08
Amount appropriated by act approved July 13, 1892	7,500.00
	7,629.08
June 30, 1893, amount expended during fiscal year	6,989.13
July 1, 1893, balance unexpended	639.95
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 20.)

21. Onancock Harbor, Virginia.—Onancock Harbor, or Onancock River, is about 5 miles long and flows through a portion of Accomac County, Va., into Chesapeake Bay. The original depth at the head of the river was 4 feet at mean low water, and at the mouth, which is obstructed by a wide bar, it was 5 feet. The average rise of the tide is 2 feet.

During the years 1880 and 1881 $8,000 was expended in dredging a channel 100 feet wide across the bar to a depth of 8 feet at mean low water and in dredging the shoals at Onancock and above Wise Point to a depth of 7 feet. The improvements were of great benefit to ship-

ping at the time, but subsequently the channel at the bar filled up again to nearly its original depth.

The present project for improvement, adopted in 1890, provides for an 8-foot low-water channel 300 feet wide at the outer bar and 200 feet wide at the inner bar, called the "Middle Ground." The estimated cost is $12,511. At the close of the fiscal year ending June 30, 1892, $5,905.19 had been expended and a channel of one half the proposed width had been dredged at both bars to a depth of 8 feet.

A contract has been made for the expenditure of the appropriation of $6,511, made July 13, 1892, in dredging the remaining width of the channel, and it is expected that the contract and project will be completed by December 31, 1893.

Nothing further is recommended.

July 1, 1892, balance unexpended	$94.81
Amount appropriated by act approved July 13, 1892	6,511.00
	6,605.81
June 30, 1893, amount expended during fiscal year	26.21
July 1, 1893, balance unexpended	6,579.60
July 1, 1893, amount covered by uncompleted contracts	6,579.60

(See Appendix H 21.)

22. Harbor and approaches at Cape Charles City, Va.—This harbor is an artificial rectangular basin of about 10 acres area, originally excavated to a depth of 12 feet just back of the shore of Chesapeake Bay about 12 miles north of Cape Charles. It is in Northampton County and forms the shore terminus of the New York, Philadelphia and Norfolk Railroad, transfer of passengers and freight being made by boat to and from Norfolk, Va. The tide rises on an average 2.6 feet.

The project for improvement proposed in a report on a survey made in 1889 provides for dredging the harbor to a depth of 14 feet and the entrance thereto and the channels in Cherrystone Inlet and across Cherrystone Bar to a depth of 16 feet below mean low water, the width at the inlet and bar to be 100 and 200 feet, respectively, and for protective works of stone at the entrance. The estimated cost of the project is $142,340.

The dredging project was adopted in 1890, and at the end of the fiscal year ending June 30, 1891, $21,676.89 had been expended in dredging about one-half of the area of the harbor to a depth of 14 feet, in widening the channel in the entrance and deepening it to 16 feet, and in removing part of a shoal in Cherrystone Inlet about a mile below the harbor to the same depth. The improvements were at the time of great benefit to the large class of vessels that daily leave and enter the harbor.

The appropriation of $10,000 made July 13, 1892, is still unavailable, as the owners of the harbor have not yet made any decision with regard to accepting the provisions of the act, and nothing therefore was done during the past fiscal year.

The dredged channel is reported as shoaling again, especially at the harbor entrance, which needs protective works.

July 1, 1892, balance unexpended	$2,654.44
Amount appropriated by act approved July 13, 1892	10,000.00
	12,654.44
June 30, 1893, amount expended during fiscal year	765.37
July 1, 1893, balance unexpended	11,889.07

Amount (estimated) required for completion of existing project.....	$10,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,400.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H 22.)

23. Removing sunken vessels or craft obstructing or endangering navigation.—During June, 1893, preparations were begun for the removal of the wreck of the tug *Charles Lea*, in Mispillion River, Delaware, under the provisions of the act of June 14, 1880, at an estimated cost of $150. (See Appendix H 23.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, William F. Smith, United States Agent, Major of Engineers, U. S. Army, retired, and reports thereon were submitted through the division engineer, Col. William P. Craighill, Corps of Engineers.

1. Mouth of St. Jones River, Delaware.—Maj. Smith submitted report of examination under date of September 20, 1892. It is his opinion and that of the division engineer, concurred in by this office, that St. Jones River is worthy of improvement to the extent of redredging the mouth. No further survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed in House Ex. Doc. No. 34, Fifty-second Congress, second session. (See also Appendix H 24.)

2. For inland waterway connecting the Mispillion and Broadkiln rivers, Delaware, so as to reopen the navigation of Cedar, Slaughter, and Primehook creeks.—Maj. Smith submitted report of examination under date of August 11, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 85, Fifty-second Congress, second session. (See also Appendix H 25.)

3. Pocomoke River, Maryland, with a view of uniting its waters with the waters of Synepuxent Bay, at a point above Snow Hill.—Maj. Smith submitted report of examination under date of August 16, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the route is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $800. The report was transmitted to Congress and printed as House Ex. Doc. No. 94, Fifty-second Congress, second session. (See also Appendix H 26.)

4. Nanticoke River, Delaware.—Maj. Smith submitted report of examination under date of August 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 120, Fifty-second Congress, second session. (See also Appendix H 27.)

5. Black Walnut River, at the mouth of Great Choptank River, Maryland.—Maj. Smith submitted report of examination under date of September 1, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the harbor is not worthy of improve-

ment by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 69, Fifty-second Congress, second session. (See also Appendix H 28.)

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND, AND JAMES RIVER, VIRGINIA.

These works were in the charge of Col. William P. Craighill, Corps of Engineers.

1. Patapsco River and channel to Baltimore, Md.—The depth of this channel has by successive steps been increased from 17 feet at mean low water to 27 feet, with an average rise of tide of about 18 inches.

The project of improvement first adopted and commenced in October, 1853, had for its object to give a channel 22 feet deep at mean low water, with a width of 150 feet.

Little was done before the late war, but afterwards these dimensions were increased, a depth of 24 feet at mean low water being determined upon, with a width of channel ranging from 250 to 400 feet.

This channel was completed in 1874, important changes of position having been given to a portion of it by which the distance was materially lessened and the expense of maintenance decreased.

The object of the improvement was to permit the approach to Baltimore, at mean low water, of vessels drawing from 22½ to 23 feet, and at ordinary high water of vessels drawing 24 and 24½ feet. Later the project had in view a depth of 27 feet at mean low water, with a width of 600 feet, to allow the entrance and departure of the largest vessels.

Up to June 30, 1892, the United States had expended $2,932,517.01. The city of Baltimore and the State of Maryland, chiefly the former, have also contributed to the same object more than $500,000. The expenditure up to June 30, 1893, by the United States was $3,186,215.10. The river and harbor act of September 19, 1890, contained the following important proviso:

Provided, That such contracts as may be desirable may be entered into by the Secretary of War for the completion of the existing project, or any part of same, to be paid for as appropriations may from time to time be made by law.

As soon as possible thereafter a contract was made with the American Dredging Company for the completion of the improvement. The work was very vigorously prosecuted and satisfactorily finished in December, 1892. The total amount of material removed and redeposited under the contract was 6,219,179 cubic yards.

The channel is now 600 feet wide with a depth of 27 feet at mean low water, the width being much greater at the turns.

Of course this channel will require repairs from time to time, like all artificial highways. The latest experience and a restudy of the conditions of the case confirm the opinion and estimate made some years ago that the maintenance of the channel after completion will require the annual expenditure of $50,000. This is, however, a small sum when contrasted with the great gain to Baltimore and her dependent interests, as well as in revenue to the United States Treasury, by the increase of the depth from 17 to 27 feet at low water, which means the introduction of many lines of deep ocean steamers to European and other foreign and domestic ports within the past twenty years, whereas there were none before of any importance. The expense of repairs is increased if they are not regularly and systematically made. The channel to Baltimore was finished in 1892 to a depth of 27 feet at mean low water. This depth can not be maintained except with occasional

work in the nature of repairs. No appropriation was made for such work in the year ending June 30, 1894, and no dredging can therefore be done. The appropriation now asked for is consequently for two years. The present small balance is held for an extraordinary contingency and necessary surveys after the completion of the work. These surveys are now in progress.

July 1, 1892, balance unexpended	$66,310.15
Amount appropriated by sundry civil act approved August 5, 1892	208,000.00
	274,310.15
June 30, 1893, amount expended during fiscal year	253,698.09
July 1, 1893, balance unexpended	20,612.06
July 1, 1893, outstanding liabilities	800.00
July 1, 1893, balance available	19,812.06
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

(See Appendix I 1.)

2. Channel to Curtis Bay in Patapsco River, Baltimore Harbor, Maryland.—The river and harbor act of 1892 contained the following item:

Improving Patapsco River, Baltimore Harbor, Maryland: For dredging a channel 150 feet wide at bottom and of a depth of 27 feet, mean low water, from the main ship channel to Curtis Bay, in accordance with recommendation of Col. William P. Craighill, Corps of Engineers, submitted December 13, 1890, $28,000.

The total estimated cost of the improvement was $85,000. The first appropriation of $28,000 has been expended in dredging to a depth of 25 feet at low water. The work, under a contract with the National Dredging Company, was commenced in November, 1892, and after considerable interruption by ice and severe weather, was satisfactorily completed in May, 1893. The channel is made 150 feet wide.

Amount appropriated by act approved July 13, 1892	$28,000.00
June 30, 1893, amount expended during fiscal year	28,000.00
Amount (estimated) required for completion of existing project	57,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	57,000.00

(See Appendix I 2.)

3. James River, Virginia.—When the improvement of the James River was regularly undertaken by the Government the navigation was obstructed by sunken vessels, by remains of military bridges, and by other obstructions put into the river during the late war to prevent the national fleets from approaching too close to Richmond.

There were also other natural obstructions. Rockett Reef and Richmond Bar had only 7 feet of water at mean low tide. From Warwick Bar to Richmond the channel was crooked and obstructed by dangerous rocks and ledges. The Dutch Gap Cut-off was not then open and the river was in a poor condition as regards its availability for commercial purposes.

The original project of improvement was to secure a depth of 18 feet at full tide (corresponding to about 15 feet at low tide) to Richmond, with a channel width of 180 feet. This project had reached an advanced state of progress when Congress, by act approved July 5, 1884, adopted another looking to 22 feet at mean low tide from the sea to

Richmond, the width to be 400 feet from the sea to City Point, 300 from thence to Drewry Bluff, and 200 feet from thence to Richmond.

The total amount expended on this river by the United States up to June 30, 1892, was $1,320,408.19, which includes the sum of $589,523.64 expended since the new project was entered upon to give a depth of 22 feet at mean low water. The condition of the river June 30, 1892, is shown by the table below, the depths being given at mean low water, as also, for comparison, the depths in 1870 before the improvement was begun, with a channel width not less than 80 feet.

	1870.	1892.
	Feet.	*Feet.*
From the city to Richmond Bar	7	13.8
Over Richmond Bar and Randolph Flats	7	15
From Randolph Flats over Warwick Bar	12.4	15.4
From Warwick Bar to City Point (least in Trents Reach)	7	*15.5
From City Point to the sea	14.8	17

*Trents Reach is now avoided by Dutch Gap Cut-off.

The amount expended in the year ending June 30, 1893, has been $62,467.69.

The work has progressed satisfactorily during the year. The most expensive and tedious part of the improvement is near the city of Richmond, where the depth of water is least, and much of the material to be removed to give greater depth is rock. When the material is such that an increase of velocity given by contracting and regulating works can remove it and thus obtain and then maintain the required depth these works have been successful and the results good. The conditions are now such that the best results can be obtained from liberal appropriations.

In the fiscal year two principal contracts have been in force, the first with Mr. C. D. Langhorne, which was completed in November, 1892; the other with Mr. John A. Curtis, dated October 15, 1892, is to be completed December 1, 1894.

Under Mr. Langhorne's contract there were removed between July 1 and November 12, 1892, 16,786 cubic yards of disintegrated rock and 1,910.9 cubic yards of solid rock from the channel above Goodes Rocks, 944.8 cubic yards of solid rock from Goodes Rocks cut and 2,909.9 cubic yards of sand, 437.2 cubic yards of loose stone, and some timber from Warwick Bar.

The work required under the new contract with Mr. Curtis includes the enlargement of the channel between Richmond city limits and Goodes Rocks to not less than 80 feet wide and 18 feet deep; the widening of Goodes Rocks cut to 80 feet, and the channel through Richmond Bar to 80 feet by 18 feet; the deepening of Dutch Gap Cut-off to 25 feet for 100 feet of its width, and redredging and enlarging the channels at Harrisons Bar and Goose Hill Flats to 200 by 18 feet. In works of regulation the wing dams on Richmond Bar and from Warwick Bar to Drewry Bluff, are to be extended to new lines of contraction, and wing dams constructed for the first time in Wards Reach, Willis Reach, and at Curles. Two of the wing dams at Varina, built in 1880 and shortened by the freshet of 1886, are to be restored, and new wing dams constructed on the right bank covering the whole length of the shoal, to produce further contraction and scour out the channel 300 by 22 feet, required by the project of 1884. The openings in training walls below Richmond Bar and in Kingsland Reach are to be closed.

Mr. Curtis, in the fiscal year 1893, has done the following work:

Locality.	Cubic yards earth.	Cubic yards cobble.	Cubic yards soft rock.	Cubic yards solid rock.
Richmond to Stearns Dike	472.9	123.8	12,264.6	142.4
Goodes Rocks	5.0	2.3	91.4	6.5
Richmond Bar	14,830.6	1,159.8	4,021.9	69.1
Total	15,308.5	1,285.9	16,377.9	218.0

447.0 linear feet of training wall (openings at Kingsland); 2,823.5 linear feet of wing dams, extensions, and new dams.

The condition of the channel June 30, 1893, is shown by the following table, the depths being at mean low water in a channel not less than 80 feet wide, the minimum width being in rock.

	Feet.
From Richmond to Richmond Bar	13.8
Over Richmond Bar	15.0
From Richmond Bar to Drewry Bluff	18.0
From Drewry Bluff to City Point*	15.5
From City Point to Hampton Roads	17.0

The present available depth for navigation at full tide is 18½ feet from the sea to Richmond Bar, and 16½ feet thence to city limits of Richmond.

When the proposed improvement is completed an annual expenditure of $20,000 will be necessary for the maintenance of the channel.

July 1, 1892, balance unexpended		$44,055.02
Amount appropriated by act approved July 13, 1892		200,000.00
		244,055.02
June 30, 1893, amount expended during fiscal year		62,467.69
July 1, 1893, balance unexpended		181,587.33
July 1, 1893, outstanding liabilities	$2,000.00	
July 1, 1893, amount covered by uncompleted contracts	124,665.89	
		126,665.89
July 1, 1893, balance available		54,921.44

Amount (estimated) required for completion of existing project	3,336,070.45
Amount that can be profitably expended in fiscal year ending June 30, 1895	400,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I 3.)

4. Removing sunken vessels or craft obstructing or endangering navigation.—Notice was received that the schooner *Pinafore* was sunk near Fort Carroll, in Baltimore Harbor, and was a dangerous obstruction to navigation. A buoy was promptly placed upon it by the light-house inspector. The masts were removed and some other of the upper works. Under the action of the ice and waves the schooner sunk in the mud so much that when preparations were made for her removal in the spring of 1893 it was not found necessary to disturb her. (See Appendix I 4.)

*Trents Reach, now avoided by Dutch Gap Cut-off, had but 7 feet in 1870.

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of *South Branch of Patapsco River, from Craighill Channel to Light Street Bridge*, and of *Middle Branch of Patapsco River, from Light Street Bridge to foot of Eutaw street, Baltimore, Md*, required by the act, were made by the local engineer, Col. William P. Craighill, Corps of Engineers, and report thereon was submitted under date of October 7, 1892. It is the opinion of Col. Craighill, concurred in by this office, that these localities are worthy of improvement. No further survey is needed for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 84, Fifty-second Congress, second session. (See also Appendix I 5.)

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON WESTERN SHORE OF CHESAPEAKE BAY.

This district was in the charge of Maj. Charles E. L. B. Davis, Corps of Engineers, with Lieut. George A. Zinn, Corps of Engineers, under his immediate orders; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Potomac River and Anacostia River at Washington, D. C.—Before the commencement of this improvement the channel to Georgetown, D. C., was narrow and crooked, and had not sufficient depth to meet the needs of commerce. Vessels drawing 16 feet frequently grounded at high tide above Long Bridge, and frequent dredging was necessary to maintain even this depth. The channel was of insufficient width, as the appropriations for dredging were too small to provide for more than a narrow cut through the bar. The Washington Channel was narrow and shoal and inadequate to the wants of commerce. Extensive mud flats existed along the city front from Observatory Hill to a point opposite the arsenal. Below Long Bridge these flats were separated from the city front by the Washington Channel. The greater portion of these flats was exposed at low tide and covered at high tide with water polluted by the sewage of the city. At the foot of Seventeenth street NW. a large sewer discharged directly upon the flats. These conditions rendered a portion of the city almost uninhabitable.

By act passed August 2, 1882, Congress adopted a project which has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation or filling of the marshes on the city front by depositing on them the material dredged from the channels, and the establishment of harbor lines beyond which no wharves or obstructions should be built. The project provides in detail for such depth of channels as will accommodate the largest vessels that can reach Arsenal Point, with such depth at the wharves as will allow vessels to receive full cargoes without grounding at low water; for filling the flats above Long Bridge to a height of 3 feet above the flood line of 1877, and the middle part of the flats below Long Bridge to the same height, but sloping each way to a height of 6 feet above low tide at the margin of the fill; that in order to purify the water in the Washington Channel, which will be cut off at its upper end from the Virginia or main channel, a tidal reservoir or basin be established above Long

Bridge, to be filled with water from the Virginia Channel on the flood tide and discharged into the Washington Channel on the ebb.

The plan also contemplates the rebuilding of Long Bridge with longer spans and fewer piers during the progress of the work, and the interception of all sewage now discharged into Washington Channel and its conveyance to James Creek, but neither the reconstruction of the bridge nor the building of the intercepting sewer were included in the estimate of the cost of the improvement.

The estimated cost of the improvement is $2,716,365.

Up to the close of the fiscal year 1892 the expenditures aggregated $1,780,318.33, and the following work had been accomplished: The Virginia Channel above Long Bridge had been deepened to 20 feet at low tide for a width of from 400 to 550 feet, a part of which has since filled up and been redredged to a width of 250 feet. The bar in the same channel below Long Bridge had been dredged to a depth of 20 feet and a width of about 350 feet. This part of the Virginia Channel has maintained itself to the full depth originally dredged or has deepened. The Washington Channel has been dredged to a depth of 20 feet for a width of 350 feet throughout its entire length and to a depth of 12 feet from the 20-foot channel nearly to the easterly margin of the fill, except a small area near the Seventh Street Wharf. This channel for the most part maintained itself until the freshet of June, 1889, when considerable filling took place. The junction of the Virginia and Washington channels had been dredged to depths of 20 feet, 15 feet, and 12 feet. The greater part of the tidal reservoir had been dredged to a depth of 8 feet. All the material dredged from the river had been deposited on the flats, and of the 12,000,000 cubic yards estimated to be required about 9,303,600 had been deposited. The entire area of the flats, about 621 acres, had been outlined, and practically the entire area to be reclaimed had been raised above overflow at ordinary high tide.

The riprap foundation for the sea wall had been put in place around the entire river front of the reclaimed area and the margin of the tidal reservoir. The construction of the sea wall, for the protection of the margin of the fill from erosion by the waves and the action of the tidal currents, had been commenced and about 13,840 linear feet of wall constructed. The construction of a dike on the westerly side of the Virginia Channel above Long Bridge, with a view to reducing the deposit at that locality, was in progress. The outlet gates at the tidal reservoir at the head of the Washington Channel had been completed, with the exception of the railing.

On the Anacostia River two bars in the channel have been dredged so as to secure 20 feet at low tide from the mouth to the navy-yard. Harbor lines have been established in accordance with the project.

The construction of the sea wall was resumed and 4,450 linear feet completed, making a total of 18,290 linear feet.

The channel through the bar (caused by the freshet of 1889) in the Virginia Channel above Long Bridge has been widened from 200 feet to 250 feet, the depth being 20 feet. This work has given timely and material relief to the coal trade of Georgetown.

Work on the training dike on the west side of this channel has been continued. Dredging has been commenced in the Washington Channel and the embankments for the deposit of the dredged material on Section III have been formed.

On the Anacostia River the Navy Department has dredged a basin 22 feet deep and from 100 to 200 feet wide in continuation of the dredg-

ing done under the direction of this Department in 1891–'92. No funds have been available for further work on this part of the improvement during the past year.

Long Bridge.—On June 30, 1892, the northerly end of the Long Bridge across the Washington Channel had been nearly reconstructed by the Baltimore and Potomac Railroad Company on plans approved by the Secretary of War, the work being incomplete owing to the settlement and movement of the abutments. The south abutment has been rebuilt during the past year.

Reference is made in the report of the officer in local charge to the necessity of rebuilding Long Bridge. In the event of a freshet occurring when the Potomac River is full of ice great damage is to be expected. The piers of the bridge are of such faulty construction that an ice gorge would be probable, which would cause the water to back up and overflow portions of the city front and through the sewers above the bridge such portions of the lower parts of the city as may be drained by them. Great damage was done by the freshet of June, 1889, but greater damage may occur from a freshet of lesser magnitude if accompanied by an ice gorge.

July 1, 1892, balance unexpended		$57,058.63
Amount appropriated by act approved July 13, 1892		200,000.00
		257,058.63
June 30, 1893, amount expended during fiscal year		63,346.42
July 1, 1893, balance unexpended		193,712.21
July 1, 1893, outstanding liabilities	$4,478.00	
July 1, 1893, amount covered by uncompleted contracts	122,319.00	
		126,797.00
July 1, 1893, balance available		66,915.21

Amount (estimated) required for completion of existing project 681,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 681,365.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix J 1.)

2. Occoquan Creek, Virginia.—Occoquan Creek is a tributary of the Potomac River, which it enters about 25 miles below Washington, D. C. Navigation was obstructed by four bars, which were improvod between 1873 and 1880 by the expenditure of four appropriations, aggregating $25,000, giving a navigable depth of about 6 feet to Occoquan, the head of navigation, 4 miles above the mouth. When the original survey was made, November, 1872, the ruling depths over the several bars were as follows: Lower Mud, 2.7 feet; Sand Bar, 4.0 feet. Occoquan Bar does not appear to have been in existence. A narrow channel had been dredged by the citizens at the Upper Mud, having a depth of 6 feet. In compliance with the provisions of the river and harbor act of August 11, 1888, a new survey was made in 1889, and the condition of the several bars found as follows:

Lower Mud, about 3.5 miles below Occoquan. This bar is about 4,000 feet long and had a ruling depth of about 3 feet. The former dredged channel had filled in.

Upper Mud, about 2.25 miles below Occoquan. The channel dredged in 1874–'75 was found to have maintained its original dimensions, being about 50 feet wide and from 5 to 6 feet deep.

Sand Bar, about one-half mile below Occoquan. The former dredged channel had filled in, the least depth being 4.2 feet.

Occoquan Bar, a short bar opposite Occoquan. The channel dredged here had filled in, and the least depth was 4 feet.

The project for the new improvement comprises the dredging of channels 6 feet deep and from 100 to 150 feet wide through the bars, with the construction of such dikes as may be required to maintain the depth secured by dredging. The first appropriation for the new work was made September 19, 1890. At the close of the fiscal year ending June 30, 1892, $9,801.99 had been expended. At that date a channel 6 feet deep and from 100 to 150 feet wide had been dredged through the Lower Mud and a channel 8 feet deep and from 70 to 100 feet wide had been dredged through Occoquan Bar.

At the last-named bar the depth was made 8 feet to anticipate probable shoaling from freshets. The depth of the sand bar had been generally increased by the sand dredges working there, while the channel at the Upper Mud remained substantially as reported from the survey of 1889.

The amount expended during the fiscal year ending June 30, 1893, has resulted in the completion of the channel through Occoquan Bar to the depth of 8 feet and the full width of 100 feet; in such dredging as was needed to complete a channel 6 feet deep and 100 feet wide through the sand bar; and in widening a considerable part of the channel at the Upper Mud to a width of 100 feet, the depth being 6 feet.

In addition to the dredging above mentioned, the greater part of a riprap dike has been built at Occoquan Bar. The contractor for this work was interrupted by an injunction from a State court or the work would have been completed.

July 1, 1892, balance unexpended		$206.01
Amount appropriated by act approved July 13, 1892		5,000.00
		5,206.01
June 30, 1893, amount expended during fiscal year		2,712.33
July 1, 1893, balance unexpended		2,493.68
July 1, 1893, outstanding liabilities	$60.00	
July 1, 1893, amount covered by uncompleted contracts	1,206.00	
		1,266.00
July 1, 1893, balance available		1,227.68

Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 2.)

3. Aquia Creek, Virginia.—Aquia Creek is a tributary of the Potomac River, which it enters about 41 miles below Washington, D. C. The stream is about 7 miles long, and in 1872 its navigation was chiefly obstructed by shoals between the mouth and the "Narrows," 4.5 miles above. Here the creek takes the character of a wide bay, from 1,000 to 6,000 feet wide, while the depth of water ranged from 2 to 4 feet over an almost continuous shoal of soft mud. Above the "Narrows" the creek is from 60 to 200 feet wide, with a depth of from 2 to 17 feet, the shoaler portions being near the head of navigation. The stream is crossed by a bridge of the Richmond, Fredericksburg and Potomac Railroad about 3 miles above the mouth, the draw of the bridge being but 28 feet wide.

From 1872 to 1878 appropriations amounting to $10,000 were made by Congress, and the navigation improved by dredging a channel from 40 to 50 feet wide and from 4 to 5 feet deep through the shoaler parts of the creek, chiefly above the railroad bridge.

A new survey of the creek was provided for in the river and harbor act of August 11, 1888, and was made in 1889. The channel dredged from 1872 to 1878 was found to have maintained its dimensions between the railroad bridge and the "Narrows," but at other places it had filled in. The general depth of water in the creek remained substantially as in 1872. Estimates for improving the navigation were submitted January 18, 1890, and an appropriation of $10,000 made by the river and harbor act of September 19, 1890.

The project for the improvement, approved December 4, 1890, proposes a channel 80 feet wide and 6 feet deep, dredged through the shoals where less than 6 feet is found between the mouth of the creek and the "Narrows."

At the close of the fiscal year ending June 30, 1892, $9,594.05 had been expended. A channel 80 feet wide and 6 feet deep had then been dredged from Thorny Point, at the lower end of the shoal, up to the railroad bridge, a distance of 12,280 feet.

The amount expended during the fiscal year was $625.20.

Proposals for the dredging were invited and a contract entered into for the same, operations to commence July 15, 1893.

July 1, 1892, balance unexpended	$610.95
Amount appropriated by act approved July 13, 1892	5,000.00
	5,610.95
June 30, 1893, amount expended during fiscal year	625.20
July 1, 1893, balance unexpended	4,985.75
July 1, 1893, amount covered by uncompleted contracts	3,300.00
July 1, 1893, balance available	1,685.75
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1835	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 3.)

4. Lower Machodoc Creek, Virginia.—Lower Machodoc Creek is a tributary of the Potomac River, which it enters on the right about 85 miles below Washington, D. C. It has a navigable length of about 4 miles, and the lower part of the stream affords a good harbor for vessels drawing 12 feet or less. In 1892 navigation was obstructed by a bar at the "Narrows" 2 miles above the mouth, over which but 4 feet could be carried at low tide. After passing the bar depths of from 10 to 14 feet are found, gradually diminishing, however, to about 6 feet at Drum Bay, the head of navigation.

The project for the improvement, based on survey of 1892, made subsequent to the appropriation of July 13, provides for dredging a channel 9 feet deep and 150 feet wide through the bar at the "Narrows" at an estimated cost of $15,000.

The first appropriation for the improvement was made July 13, 1892, the amount being $3,000.

During the fiscal year ending June 30, 1893, $227.65 has been expended. A survey of the bar has been made and dredging commenced.

Amount appropriated by act approved July 13, 1892		$3,000.00
June 30, 1893, amount expended during fiscal year		227.65
July 1, 1893, balance unexpended		2,772.35
July 1, 1893, outstanding liabilities	$86.00	
July 1, 1893, amount covered by uncompleted contracts	2,394.00	
		2,480.00
July 1, 1893, balance available		292.35

Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 4.)

5. *Nomini Creek, Virginia.*—This stream is an important tributary of the Potomac, which it enters about 82 miles below Washington, D. C.

Navigation was obstructed in 1872 by a bar of sand and oyster shells at its mouth, over which but 3 feet could be carried at low tide, and the dangers and difficulties of passing the bar were further increased by a rapid current and cross tides. After passing the bar 8 feet can be carried to Nomini Ferry, about 4 miles above the mouth.

The original project for the improvement, adopted in 1873, provided for dredging a channel 100 feet wide and 9 feet deep through the bar. The project was modified in 1879 by increasing the width to 150 feet, and again in 1885 by increasing the width to 200 feet. In 1890 a further modification was made, proposing the construction of two jetties parallel to the outer channel, retaining the width of dredging at 150 feet. The total cost of this modified project was placed at $72,500. At the close of work in 1883 a channel about 100 feet wide and 9 feet deep had been dredged through the bar. During the suspension of work from 1883 to 1889 the cut was reduced in depth and width by deposits of sand. In 1889 the outer channel was widened and redredged on the westerly side for a width of 94 feet and a length of 1,470 feet, the depths being from 8.9 to 13.8 feet.

During the fiscal year ending June 30, 1891, the channel at and outside of White Point was dredged, the width attained being from 130 to 150 feet, and the depth 9 feet. A riprap dike was built inside White Point to check the cross tidal current. Up to June 30, 1892, $42,211.76 had been expended.

During the fiscal year ending June 30, 1893, $1,665.35 has been expended. Two hundred linear feet of the east jetty outside White Point has been finished during the year.

July 1, 1892, balance unexpended		$288.24
Amount appropriated by act approved July 13, 1892		10,000.00
		10,288.24
June 30, 1893, amount expended during fiscal year		1,665.35
July 1, 1893, balance unexpended		8,622.89
July 1, 1893, outstanding liabilities	$75.00	
July 1, 1893, amount covered by uncompleted contracts	7,658.00	
		7,733.00
July 1, 1893, balance available		889.89

Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 5.)

6. Patuxent River, Maryland.—The present head of navigation on the Patuxent River is Bristol, Md., about 46 miles above the mouth. Prior to the commencement of the improvement navigation below Bristol was obstructed by two mud bars, (1) Swann Point Bar, about 43 miles above the mouth, having a least depth of 7.8 feet, and (2) Bristol Bar, at Bristol, having least depths in front of the two wharves of 7.6 and 4.2 feet. Two other bars below, viz, Pope Shoal (24 miles above the mouth) and Warren Reach Bar (34 miles above the mouth), were mentioned in the report of the preliminary examination as worthy of survey, but they offer no obstruction to the present standard of navigation.

The original project was adopted in 1888, and contemplated dredging a cut 200 feet wide and from 12 to 13 feet deep through Swann Point Bar and Bristol Bar, so as to secure a permanent channel about 100 feet wide and 12 feet deep at low tide. This project was modified in 1890 so as to provide for a channel 120 feet wide and 12 feet deep (then already dredged) at Bristol Bar and a channel 100 feet wide and 9 feet deep at Swann Point Bar, these last named dimensions being regarded as sufficient for the present and immediately prospective demands of commerce.

At the close of the fiscal year ending June 30, 1892, $10,079.13 had been expended. A channel 120 feet, 12 feet deep, and 794 feet long had been dredged at Bristol Bar, and a channel 9 feet deep, about 100 feet wide, and about 2,250 feet long through Swann Point Bar.

This work completes the existing project, unless it should appear from future examinations that works of contraction are needed to maintain the channel at Swann Point Bar. At the present time no further appropriations are recommended.

July 1, 1892, balance unexpended	$920.87
June 30, 1893, amount expended during fiscal year	65.00
July 1, 1893, balance unexpended	855.87

(See Appendix J 6.)

7. Rappahannock River, Virginia.—The obstructions to navigation of the Rappahannock River before improvement were nine bars between Tappahannock, 41 miles above the mouth, and Fredericksburg, 106 miles above the mouth, over which the ruling depths were from 4 to 10.5 feet. The chief obstructions were in the 12.5 miles of river below Fredericksburg, where seven of the bars are found. Of these bars, Fredericksburg Bar, with a least depth of 4 feet, and Spottswood Bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The original project, adopted in 1871, proposed a channel 10 feet deep and 100 feet wide through all the bars. This was modified in 1879 by increasing the dimensions of the channel between Port Royal and Tappahannock to 15 feet in depth and 200 feet in width to accommodate the larger class of vessels.

Up to June 30, 1892, $90,500 had been expended on the original project and $123,066.38 on the modified project, making a total, including outstanding liabilities, of $213,566.38, and depths of from 8.4 to 9.5 feet secured through the bars between Fredericksburg and Port Royal by dredging and the construction of dikes. Wrecks and snags obstructing navigation had also been removed. During the fiscal year ending June 30, 1893, $8,200.86 has been expended. Fourteen snags have been removed between Fredericksburg and Port Royal and 711.6 linear feet of dike built at Fredericksburg Bar. The redredging of a channel 100 feet wide and 10 feet deep at Fredericksburg Bar is in progress.

As each recurring freshet brings additional deposits of sand and silt into the river, the officer in charge recommends an annual appropriation of $7,500 for the maintenance of the improvement.

July 1, 1892, balance unexpended		$2,969.59
Amount appropriated by act approved July 13, 1892		20,000.00
		22,969.59
June 30, 1893, amount expended during fiscal year		8,200.86
July 1, 1893, balance unexpended		14,768.73
July 1, 1893, outstanding liabilities	$1,998.00*	
July 1, 1893, amount covered by uncompleted contracts	11,395.00	
		13,393.00
July 1, 1893, balance available		1,375.73

Amount (estimated) required for completion of existing project	144,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 7.)

8. Urbanna Creek, Virginia.—Urbanna Creek is a tributary of the Rappahannock River, which it enters 16 miles above the mouth. Before improvement navigation was obstructed by a bar outside the mouth, over which but 6.5 feet could be carried, and a shoal within the creek having a least depth of 7 feet.

The original project adopted in 1879 provided for dredging a channel 150 feet wide and 10 feet deep through the outer bar. This project was extended in 1883 so as to include dredging to 10 feet through a shoal within the creek near the town of Urbanna.

Up to the close of the fiscal year ending June 30, 1892, $20,534.04 had been expended. The channel through the outer bar had been dredged to a depth of 10 feet and a width of 140 feet, but owing to the action of storms the width had decreased from sand filling to 110 feet and shoaled to depths of from 8½ to 9½ feet.

A channel had also been dredged through the shoal within the creek from 80 to 170 feet wide and 10 feet deep, and dikes and jetties had been built along the sand spit to check the movement of sand, which tends to close the natural channel at the end of the spit. This channel was widened 70 feet by dredging off the end of the sand spit. The depth made was 10 feet at low tide.

An appropriation of $3,000 was made July 13, 1892, which will be applied to widening and deepening the channel through the outer bar. This work was in progress at the close of the fiscal year ending June 30, 1893, and at that date the channel was 10 feet deep and 120 feet wide.

July 1, 1892, balance unexpended		$1,140.96
Amount appropriated by act approved July 13, 1892		3,000.00
		4,140.96
June 30, 1893, amount expended during fiscal year		1,847.44
July 1, 1893, balance unexpended		2,293.52
July 1, 1893, outstanding liabilities	$149.00	
July 1, 1893, amount covered by uncompleted contracts	1,841.00	
		1,990.00
July 1, 1893, balance available		303.52

*$1,916.97 due on contract of Geo. E. Ward, dated April 5, 1889.

Amount (estimated) required for completion of existing project	$10,080.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,080.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 8.)

9. York River, Virginia.—The Pamunkey and Mattaponi rivers unite at West Point, Va., to form the York River, which is 41 miles in length and empties into Chesapeake Bay about 16 miles above Old Point, Va. Prior to the commencement of the improvement navigation was obstructed by Potopotank Bar, 9 miles below West Point, on which the ruling depth was 18.5 feet; by West Point Bar, extending about 2 miles below West Point and having a ruling depth of 15.5 feet; and by shoal water in front of the West Point wharves, at the mouth of the Pamunkey.

The original project provided for a channel 22 feet deep and 200 feet wide through these bars, with an increased width at the wharves. In 1884 the proposed channel width was increased to 400 feet, and in 1887 the project was amended so as to include the construction of a dike along the flats on the right of the channel to contract the waterway and maintain the depth dredged, which had decreased from continued silting.

Up to the close of the fiscal year ending June 30, 1892, $145,924.18 had been expended in the following work: A channel 105 feet wide and 22 feet deep was dredged in 1880–'81 through Potopotank Bar, which had, however, shoaled in 1890 to from 20.8 to 21.7 feet. A channel 22 feet deep and from 161 to 257 feet wide, with a center cut 24 feet deep and 40 feet wide, had been dredged at West Point Bar below the wharves, but this channel has shoaled to such an extent that much redredging has been necessary. The channel in front of the West Point wharves has been dredged to a width of 160 feet and a depth of 22 feet, the length being 2,700 feet.

During the fiscal year ending June 30, 1893, the construction of the dike at West Point Bar was commenced and at the close of the year was still in progress.

Great difficulty has been experienced in finding suitable dumping grounds on the York River. The flats on either side of the channel are largely occupied by oyster beds, whose owners object to the dumping of material or the construction of dikes.

July 1, 1892, balance unexpended		$12,825.82
Amount appropriated by act approved July 13, 1892		35,000.00
		47,825.82
June 30, 1893, amount expended during fiscal year		2,353.42
July 1, 1893, balance unexpended		45,472.40
July 1, 1893, outstanding liabilities	$90.60	
July 1, 1893, amount covered by uncompleted contracts	37,690.00	
		37,780.00
July 1, 1893, balance available		7,692.40

Amount (estimated) required for completion of existing project	115,050.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 9.)

10. Mattaponi River, Virginia.—The Mattaponi River is navigable for small steamers from its mouth, at West Point, Va., to Ayletts, Va.,

a distance of about 52 miles, and can be made navigable for barges for about 26 miles above Ayletts to Munday Bridge. The obstructions to 5.5-foot navigation are five bars below Ayletts, having ruling depths of from 2.5 to 3.6 feet, and wrecks, snags, logs, and overhanging trees. There were eight bars reported above Ayletts, but no improvement of them is proposed.

The approved project adopted in 1880 provides for a channel 40 feet wide and 5.5 feet deep through the bars below Ayletts and the removal of logs, snags, overhanging trees, wrecks, etc., as far up as Munday Bridge. The river and harbor act of July 13, 1892, directed the expenditure of $1,500 in improvement of the river between Ayletts and Guinea Bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad.

Up to the close of the fiscal year ending June 30, 1892, $19,167.39 had been expended in removing snags, wrecks, logs, and other obstructions between Robinson Bar and Munday Bridge, a distance of 34 miles, and in building 2,226 linear feet of dike at Robinson Bar, and in the construction of the plant necessary for these operations.

During the fiscal year ending June 30, 1893, the removal of snags was in progress under the appropriation of $4,000, made July 13, 1892.

July 1, 1892, balance unexpended	$132.61
Amount appropriated by act approved July 13, 1892	4,000.00
	4,132.61
June 30, 1893, amount expended during fiscal year	930.91
July 1, 1893, balance unexpended	3,201.70
July 1, 1893, outstanding liabilities	336.00
July 1, 1893, balance available	2,865.70
Amount (estimated) required for completion of existing project	48,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J 10.)

11. Pamunkey River, Virginia.—The Pamunkey River has a navigable length of 59 miles, and empties into the York River at West Point, Va. Navigation was originally obstructed by five bars in the upper part of the river and by snags, logs, and overhanging trees.

The project was adopted in 1880 and amended in 1885, and provides for channels 100 feet wide and 7 feet deep through Spring Bar and Skidmore Bar, or to a distance of 47 miles above West Point, and channels 40 feet wide and from 3 to 5 feet deep through the bars above, together with the removal of logs, wrecks, snags, and overhanging trees.

The amount expended to June 30, 1892, was $18,446.66. Snags, logs, and overhanging trees had then several times been removed from 22.5 miles of the river between Garlick Ferry and Hanovertown; dikes had been built at Spring Bar and Skidmore Bar, and a channel 95 feet wide and from 6 to 7 feet deep had been dredged through Skidmore Bar. The plant necessary for snagging operations, pile driving, etc., had been constructed, being paid for in part from appropriations for this river. No work has been done during the fiscal year ending June 30, 1893, the plant being engaged on the Rappahannock River and the Mattaponi River, and not available for the Pamunkey.

July 1, 1892, balance unexpended	$53.34
Amount appropriated by act approved July 13, 1892	3,000.00
	3,053.34
June 30, 1893, amount expended during fiscal year	53.34
July 1, 1893, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	7,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix J 11.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. Charles E. L. B. Davis, Corps of Engineers, and reports thereon submitted through the division engineer, Col. William P. Craighill, Corps of Engineers.

1. Mouth of Parish Creek, Maryland.—Maj. Davis submitted report of examination under date of November 30, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 106, Fifty-second Congress, second session. (See also Appendix J 12.)

2. Wicomico River, Western Shore of Maryland.—Maj. Davis submitted report of examination under date of November 25, 1892. It is his opinion and that of the division engineer, concurred in by this office, that this river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 63, Fifty-second Congress, second session. (See also Appendix J 13.)

3. Obstruction at mouth of Little Wicomico River, Virginia.—Maj. Davis submitted report of examination under date of December 14, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 137, Fifty-second Congress, second session. (See also Appendix J 14.)

4. Obstruction at mouth of Morattico Creek, Virginia.—Maj. Davis submitted report of examination under date of November 30, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the creek is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 62, Fifty-second Congress, second session. (See also Appendix J 15.)

5. Bar at mouth of Milford Haven, Virginia.—Maj. Davis submitted report of examination under date of November 29, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $600. The report was transmitted to Congress and printed as House Ex. Doc. No. 59, Fifty-second Congress, second session. (See also Appendix J 16.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

This district was in the charge of Lieut. Edward Burr, Corps of Engineers; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Harbor of Norfolk and its approaches, Virginia.—In 1877, previous to the commencement of the present improvement, the harbor of Norfolk was obstructed by shoals at the mouths of the Eastern and Southern branches, the shoal in the Eastern Branch being about one-third of a mile long, with a low-water depth of 15 to 16 feet, and the shoal in the Southern Branch being short and with a depth of 22 to 23 feet. The approaches to the harbor were obstructed by shoals at Sewall Point 3 miles long, with a low water depth of 20 feet, and at the mouth of the Western Branch 1 mile long, with a low-water depth of 19 feet. The depths on these shoals and the widths of the channels, particularly in the inner harbor where encroached upon by the Portsmouth and Berkley flats, were insufficient for the requirements of the port.

The plan of improvement adopted in 1878 was to deepen and widen the channels at the mouth of the Southern Branch and along Portsmouth and Berkley flats in the harbor proper, and to improve the approaches to the harbor by dredging a channel 500 feet wide and 25 feet deep at ordinary low water through the shoals at Sewall Point and at the mouth of the Western Branch.

The revised project of 1885 is as follows: (1) To dredge a channel, not less than 500 feet wide and 25 feet deep at ordinary low water, from the deep water in Hampton Roads to Norfolk and the United States navy-yard, on the Southern Branch, and also to dredge a channel in the Eastern Branch not less than 22 feet deep at ordinary low water, with a width of 700 feet at its mouth and of not less than 300 feet at the Norfolk and Western Railroad Bridge; (2) to ultimately dredge the entire area bounded by lines parallel to and 75 feet from the port-warden lines to a depth not less than 25 feet from Fort Norfolk to the United States navy-yard, and not less than 22 feet from the mouth of the Eastern Branch to Campostella Bridge, and to build a bulkhead at Berkley Flats.

To the project of 1885 there was added, in 1890, the dredging of an anchorage at the mouth of the Western Branch, with a depth of not less than 25 feet at ordinary low water, at an estimated cost of $150,000, which amount was added to the original estimate.

With slight modifications all operations have been conducted in accordance with the adopted projects.

The amount expended on this improvement to June 30, 1892, was $629,242.99, from which resulted a channel, not less than 500 feet wide and 25 feet deep at ordinary low water, from Hampton Roads to Norfolk Harbor, a channel of the same depth and from 125 feet to 500 feet wide in the Southern Branch to the United States navy-yard, and a channel not less than 22 feet deep at ordinary low water and from 300 feet to 500 feet wide in the Eastern Branch to the Norfolk and Western Railroad Bridge.

The channels thus dredged were in good condition, with the exception of the bar at the mouth of the Southern Branch, which by 1889 had shoaled to 22 feet and had not been redredged.

One hundred and fifty thousand dollars was appropriated for this improvement by act of July 13, 1892, and a contract was made with the Morris and Cumings Dredging Company of New York, N. Y., to remove about 1,000,000 cubic yards of material, the contract to be com-

pleted by December 31, 1893. Dredging was commenced under this contract in November, 1892, and continued to the end of the fiscal year, 917,170 cubic yards of material being removed and redeposited on Willoughby Bank to the eastward of the Ripraps in Hampton Roads. Of this amount 142,282 cubic yards was removed from Berkley Flats, at and above the mouth of the Eastern Branch; 93,088 cubic yards was removed from Portsmouth Flats and the bar, at the mouth of the Southern Branch; 170,572 cubic yards was removed from the flat opposite Atlantic City, and 383,019 cubic yards was removed from the anchorage at the mouth of the Western Branch.

A portion of Berkley Flats, 4,000 feet long and of a maximum width of 400 feet, was dredged to a depth of not less than 22 feet at ordinary low water, increasing the width of the channel in the Eastern Branch to 1,050 feet at the mouth and to 500 feet nearly to the Norfolk and Western Bridge. The bar at the mouth of the Southern Branch and a portion of Portsmouth Flats were dredged to a depth of not less than 25 feet at ordinary low water, giving a channel from 400 feet to 650 feet wide in the Southern Branch to the United States Navy-yard. A portion of the flat opposite Atlantic City, 3,400 feet long and with a maximum width of 450 feet, was dredged to a depth of not less than 25 feet at ordinary low water, increasing the width of the channel at this point to 700 feet. The dredging at the mouth of the Western Branch produced 24 acres of the proposed anchorage with a depth of not less than 25 feet at ordinary low water, excepting over a number of old wrecks that were uncovered by the dredging and have not yet been removed. As the result of the operations of the past two years 56 acres of the proposed anchorage has been dredged and 17 acres requiring no dredging has been made available.

The amount expended during the fiscal year on this improvement was applied to payments on contract, repairs to plant, office, and operating expenses, etc.

July 1, 1892, balance unexpended		$5,788.30
Amount appropriated by act approved July 13, 1892		150,000.00
		155,788.30
June 30, 1893, amount expended during fiscal year		114,331.87
July 1, 1893, balance unexpended		41,456.43
July 1, 1893, outstanding liabilities	$23,925.37	
July 1, 1893, amount covered by uncompleted contracts	11,691.70	
		35,617.07
July 1, 1893, balance available		5,839.36
Amount (estimated) required for completion of existing project		307,744.56
Amount that can be profitably expended in fiscal year ending June 30, 1895		200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix K 1.)

2. Approach to Norfolk Harbor and the United States (Norfolk) navy yard, between Lambert Point and Fort Norfolk.—In its original condition this portion of the approach to Norfolk Harbor was obstructed by a shoal at the mouth of the Western Branch, about 1 mile long, with a depth of 19 feet at ordinary low water.

The project of 1878 was to dredge through this shoal a channel 500 feet wide with a depth of not less than 25 feet at ordinary low water.

The revised project of 1886 is (1) to secure a channel not less than 500 feet wide and 25 feet deep at ordinary low water from Lambert

Point to Fort Norfolk by the construction of a dike and by dredging, and (2) to ultimately widen this channel to within 75 feet of a straight line drawn from Fort Norfolk to the deep water off Lambert Point, 6,800 feet of which is the proposed port-warden line, making the channel at least 700 feet wide.

The amount expended on this improvement between July 5, 1884, and June 30, 1892, was $197,500, from which resulted a channel between Lambert Point and Fort Norfolk 700 feet wide and 25 feet deep at ordinary low water and a channel of the same depth and 600 feet wide from deep water off Lambert Point to the port-warden line.

There were no expenditures during the fiscal year ending June 30, 1893, for this improvement.

The project of 1886 has been completed with the exception of the dike. The survey of 1889 and examinations of April, 1890, and May, 1891, did not show any shoaling of the dredged channel. A survey made in May, 1892, shows a shoaling on the eastern side of the channel thought not to be due to natural causes. This can only be determined by later surveys, but it is thought that the dike will not be necessary for the maintenance of the channel. No further appropriations will be required for this project at present.

{ Amount (estimated) required for completion of existing project $108,000.00
{ Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix K 2.)

3. Nansemond River, Virginia.—This river is one of the important tributaries of Hampton Roads, Virginia, and is navigable at high water for vessels drawing 11 feet as far as the city of Suffolk, 16 miles from its mouth.

Five railroads, two of which terminate at this place, put this city in communication with the South and West, and two lines of steamers run between it and Norfolk and Baltimore.

In 1872, before any improvement was undertaken, the navigable channel of the Nansemond River was 5 feet deep at low water and was much obstructed by wrecks, snags, etc.

Between 1873 and 1878 the Government dredged a channel, wherever necessary, 8 feet deep at low water, from Suffolk to Hampton Roads, at a cost of $37,000. This depth not being sufficient to meet the demands of its growing commerce, in obedience to the requirements of the river and harbor act of August 5, 1886, an examination and survey of the river were made to determine what other improvement was necessary.

The plan of improvement then proposed and since adopted is to secure a channel not less than 100 feet wide at bottom, 12 feet deep at mean low water, from the head of navigation to the mouth of the Western Branch, 5.37 miles, including a turning basin 200 feet square, 300 feet below Suffolk Bridge, by dredging and by the construction of spurs and training walls; and a channel of like depth from the mouth of the Western Branch to deep water at Town Point, 200 feet wide at bottom at its upper end and gradually increasing to at least 400 feet at its lower end, etc., the total estimated cost being, in round numbers, $152,500.

The amount expended on the present project to June 30, 1892, was $8,625.83, which was applied to dredging a channel 40 feet wide and 11 feet deep at ordinary low water through Suffolk Shoal, and to repairs to dikes.

Ten thousand dollars was appropriated for this improvement by act of September 19, 1890, and a contract was made with the Alabama Dredging and Jetty Company, of Mobile, Ala., to do the required dredging, the work to be completed by June 30, 1892.

The contractors failed to commence the work before the time set for the completion of their contract. Upon their application an extension of sixty days to the contract time was granted and subsequently the contract was further extended sixty days. Dredging was commenced in July, 1892, and the contract completed in October, 1892. Forty-two thousand and twelve cubic yards of material was removed and redeposited on the flats in Hampton Roads to the westward of the mouth of the river. A channel 80 feet wide and not less than 12 feet deep at mean low water was dredged through three shoals from 2 miles to 3½ miles below Suffolk Bridge.

Ten thousand dollars was appropriated for this improvement by act of July 13, 1892, and a contract was made with the Rittenhouse Moore Dredging Company of Mobile, Ala., to do the required dredging, the work to be completed by April 30, 1894.

Under this contract dredging was commenced in March, 1893, and completed in May, 1893. Thirty-seven thousand four hundred and fifty-eight cubic yards of material was removed and redeposited in Hampton Roads, as in the previous contract. A channel 80 feet wide and not less than 12 feet deep at mean low water was dredged through two shoals from one-half mile to 2 miles below Suffolk Bridge and the channel through Suffolk Shoal was increased in width by a cut 1,375 feet long and of the same depth.

The amount expended on this improvement during the fiscal year ending June 30, 1893, was applied to payments on contract, office, and operating expenses, etc.

July 1, 1892, balance unexpended	$11,374.17
Amount appropriated by act approved July 13, 1892	10,000.00
	21,374.17
June 30, 1893, amount expended during fiscal year	21,342.89
July 1, 1893, balance unexpended	31.28

Amount (estimated) required for completion of existing project	122,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 3.)

4. Chickahominy River, Virginia.—This river is one of the principal tributaries of the James River, and is navigable at high water for vessels drawing 12 feet to Binn Bar, 2½ miles below Windsor Shades. The latter place is the head of navigation, and is 25 miles from the mouth of the river.

Previous to any improvement the channel from Binn Bar to Windsor Shades was obstructed by several shoals with a depth of 4 to 5 feet at low water, and the entrance to the river was obstructed by a bar.

The present project of improvement is to dredge a channel from 100 to 150 feet wide and not less than 8 feet deep at low water through the shoals near the head of navigation, and a channel 200 feet wide and 14 to 15 feet deep at low water through the bar at the entrance. The rise of the tide is about 3 feet.

The amount expended on the present project to June 30, 1892, was $23,813.69. The channel through the bar at the entrance to the river

has been dredged to the projected dimensions. The channel through the shoals between Binn Bar and Windsor Shades has been dredged to not less than 8 feet deep at low water and to a width of 60 feet, excepting a part of Windsor Shades Bar, where the width is 40 feet.

Five thousand dollars was appropriated for this improvement by act of July 13, 1892, and a contract was made with Chester T. Caler, of Norfolk, Va., to do the required dredging, the work to be completed by April 30, 1894. Operations under this contract have not yet been commenced.

July 1, 1892, balance unexpended	$187.31
Amount appropriated by act approved July 13, 1892	5,000.00
	5,187.31
June 30, 1893, amount expended during fiscal year	15.02
July 1, 1893, balance unexpended	5,172.29
July 1, 1893, amount covered by uncompleted contracts	4,700.00
July 1, 1893, balance available	472.29

(See Appendix K 4.)

5. Appomattox River, Virginia.—This river is one of the principal tributaries of the James River, into which it empties at City Point, Va. It is navigable as far as the city of Petersburg, about 11 miles from its mouth, and before improvement had a tortuous channel, obstructed by shoals, over which there was about 6½ feet of water at high tide.

The project for this improvement was adopted in 1870 and provided for a channel 60 feet wide at bottom and 12 feet deep at ordinary high water. As subsequently modified the project is to provide a channel from Petersburg to natural deep water at Point of Rocks, 80 feet wide at the bottom and 12 feet deep at ordinary high water, by dredging, by constructing regulating and contracting works, and by making a cut-off called Puddledock Cut. With slight modifications of details all operations have been conducted in accordance with this project.

This stream is subject irregularly to freshets by which large quantities of sand are brought down and deposited in the navigable portion of the river. The currents of ordinary stages of the river have not sufficient power to remove the shoals thus formed, and a sum of $10,000 per annum is estimated as required for their removal by dredging, and for repairing damages to contracting and regulating works by freshets and deterioration. The sums appropriated for this improvement have for many years been but little in excess of the amount required for the repairs to the channel and the works already constructed. The completion of the permanent improvement of the river has consequently dragged beyond all reason, and the apparent cost of the improvement has been much in excess of the original estimates, while the actual amount expended in accordance with these estimates has been but a small proportion of the total expenditures.

The amount expended by the United States on this improvement to June 30, 1892, was $404,587.63.

By 1875 a channel 60 feet wide and 12 feet deep at ordinary high water had been secured from Petersburg to Point of Rocks, by dredging such shoals as required it and by making a cut-off called Puddledock Cut. This channel was subsequently increased in width to 80 feet, and has been maintained with a depth of 11 to 12 feet as constantly as possible by redredging shoals formed by freshets and by constructing contracting and regulating works.

The dredging of shoals formed by winter and spring freshets was begun at the end of June, 1892. Shoals in Magazine Bend, at the head

of Puddledock Cut, in the South Channel, and above Sunken Island were dredged to a depth of not less than 12 feet at ordinary high water. Thirty-one thousand three hundred and twenty-five cubic yards of material was removed, of which 11,800 cubic yards was redeposited on the banks and 19,425 cubic yards was deposited in making a portion of the dam at the Closure Dike, head of Puddledock Cut. Brush dikes were refilled where they required it and repairs were made to the Closure Dike. A dam for retaining a part of the freshet flow was built at the Closure Dike. The upper part of this dam was built of the sand dredged from shoals and the lower 1,243 feet of timber cribs filled with gravel. A freshet early in May, 1893, damaged the unfinished part of this dam. The damages were repaired and the unfinished portion filled with stone.

The amount expended on this improvement during the fiscal year ending June 30, 1893, was applied to the work noted above, to office and operating expenses, etc.

July 1, 1892, balance unexpended	$4,162.37
Amount appropriated by act approved July 13, 1892	15,080.00
	19,242.37
June 30, 1893, amount expended during fiscal year	11,961.50
July 1, 1893, balance unexpended	7,280.87
July 1, 1893, outstanding liabilities	751.92
July 1, 1893, balance available	6,528.95
Amount (estimated) required for completion of existing project	48,090.00
Amount that can be profitably expended for maintenance and repairs during fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 5.)

6. Inland water route from Norfolk, Virginia, to Albemarle Sound, North Carolina, through Currituck Sound.—This is one of the most important links in the chain of inland water communication along the Atlantic coast.

It connects Chesapeake Bay with Albemarle Sound and is composed of the following bodies of water: Elizabeth River, North Landing River, Currituck Sound, Coanjok Bay, North River, and the Albemarle and Chesapeake Canal. With the exception of the canal, which was constructed and is maintained by private enterprise, all are natural waterways.

Before any improvement was undertaken by the Government there was over this route an indifferent channel 5 to 7 feet deep at low water, the navigation of which was obstructed by overhanging growth, snags, and sharp bends in all the rivers.

The project adopted was to secure a channel 80 feet wide and 9 feet deep at low water over the entire route, about 58 miles, by dredging, by removing obstructions, and by constructing a dike.

Steady progress has been made toward securing this result, and at present the regular steamboat lines running between North Carolina ports and Norfolk and Baltimore employ vessels whose maximum dimensions are: length, 190 feet; width, 25.2 feet; draft, 8 feet, and tonnage, 421 tons.

In the river and harbor acts before that of September 19, 1890, three separate items were inserted for this improvement; in that of September 19, 1890, and in subsequent acts, one item was made to cover the entire route.

The amount expended on this improvement to June 30, 1892, was $243,832.28.

Nine thousand dollars was appropriated for this improvement by act of July 13, 1892, and a contract was made with Chester T. Caler, of Norfolk, Va., to do the required dredging, the work to be completed by April 30, 1894. Operations under this contract have not yet been commenced.

There was expended on this improvement during the fiscal year ending June 30, 1893, $38.83, applied to office expenses, reading tide gauges, etc.

July 1, 1892, balance unexpended	$738.57
Amount appropriated by act approved July 13, 1892	9,000.00
	9,738.57
June 30, 1893, amount expended during fiscal year	38.83
July 1, 1893, balance unexpended	9,699.74
July 1, 1893, amount covered by uncompleted contracts	8,800.00
July 1, 1893, balance available	899.74

Amount (estimated) required for completion of existing project	49,667.08
Amount that can be profitably expended in fiscal year ending June 30, 1895	49,667.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K 6.)

7. North Landing River, Virginia and North Carolina.—This river forms a part of the "Inland water route from Norfolk Harbor to Albemarle Sound" described above.

Before improvement the navigation of this river was obstructed by shoals, over which the depth was 6 feet at low water, by snags, and by sharp bends.

The plan of improvement, adopted in 1879, was to secure a channel 80 feet wide and 9 feet deep at low water by dredging shoals and removing bends and obstructions.

This project was completed June 30, 1884, at a cost of $49,777.34, and the desired channel obtained over a distance of 17 miles. Since that time $3,057.35 has been expended on this river in removing sunken logs which have become detached from passing rafts, making the total expenditure on this improvement to June 30, 1892, $52,834.69.

The river was cleared of sunken logs in August and September, 1892, these obstructions having by that time become troublesome to navigation. Twelve miles of the river was covered by these operations and there were removed 624 saw logs, 25 stumps, 6 trees, and 3 piles. The method adopted for rafting logs in these waters is very faulty, resulting in a considerable loss of logs to the owners and a material obstruction to navigation on this river and the connecting portions of the "Inland water route," by decreasing the available navigable depth by at least 1 foot and by remaining a menace to the hulls and propellers of passing vessels.

The amount expended on this improvement during the fiscal year ending June 30, 1893, was applied as noted above. There is still a small balance on hand for the continuance of logging operations, and no further appropriation is necessary.

July 1, 1892, balance unexpended	$2,665.31
June 30, 1893, amount expended during fiscal year	1,152.50
July 1, 1893, balance unexpended	1,512.81

(See Appendix K 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—Wrecks of the schooners Lulu, Edith Berwind, and Mary E. H. G. Dow.—The three-masted wooden schooner *Lulu*, loaded with coal, went ashore on the Horse Shoe, Chesapeake Bay, and became a wreck. The four-masted wooden schooners *Edith Berwind* and *Mary E. H. G. Dow*, loaded, respectively, with phosphate rock and with coal, went ashore on the Nautilus Shoal and the Outer Middle Ground, respectively, Cape Charles, Va., and became wrecks. They were allowed by their owners to remain as obstructions to navigation for periods longer than two months, and, it having become apparent that their owners did not propose to remove them, the thirty days' notice required by law was published and specifications for their removal were issued.

A contract was entered into on June 19, 1893, with W. H. French, of Norfolk, Va., for their removal, at a cost of $1,500 for the *Lulu*, $1,700 for the *Edith Berwind*, and $1,800 for the *Mary E. H. G. Dow*, the work to be commenced by July 1, 1893, and completed by August 31, 1893.

(See Appendix K 8.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *harbor at Petersburg and Appomattox River, Virginia, for diversion of waters to Old North Channel above city*, required by act of July 13, 1892, was made by the local engineer, Lieut. Edward Burr, Corps of Engineers, and report thereon, dated October 8, 1892, submitted through the division engineer, Col. William P. Craighill, Corps of Engineers. It is the opinion of Lieut. Burr and of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government in the manner mentioned in the act. The report was transmitted to Congress and printed as House Ex. Doc. No. 113, Fifty-second Congress, second session. (See also Appendix K 9.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN VIRGINIA, NORTH CAROLINA, AND SOUTH CAROLINA.

This district was in the charge of Maj. W. S. Stanton, Corps of Engineers, with Lieut. E. W. Van C. Lucas, Corps of Engineers, under his immediate orders; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Staunton River, Virginia.—The improvement has been restricted to two sections, aggregating 65 miles in length and separated by an interval of 20½ miles.

When, in 1879, the United States commenced the improvement of the lower section, 31½ miles long, from Randolph up to Brook Neal, the channel depth at about 18 rock ledges was only 1 to 2 feet, but elsewhere 4 to 5 feet at low water.

The project of 1879, not since modified, was to secure a boat channel way 35 feet wide and at least 2 feet deep at low water throughout the 31½ miles.

When, in 1883, the United States commenced the improvement of the upper section, 23½ miles long, from the Virginia Midland Railroad Bridge up to Pig River, the channel depth at about 20 rock shoals was only about 0.4 foot, and elsewhere about 2 feet at ordinary stages of water.

The project of 1883, as modified in 1884 and 1887, was to secure a bateau channel way 14 feet wide and 1½ feet deep over the entire section.

To June 30, 1892, $44,500 was expended upon the improvement of the two sections.

At that date the proposed channel had been obtained for 29½ miles of the middle part of the lower section and for 18½ miles of the upper section, giving for the 31½ miles of the former a fairly cleared channel for steamers of 2 feet draft and of about 25 tons burden, and making navigation for pole boats fairly good over the entire upper section up to Pig River.

October 31 and November 9, 1891, the discontinuance of the improvement was recommended by the district engineer and division engineer, and approved November 10, 1891, by the Chief of Engineers, who directed that the disposal of the plant pertaining to the improvement be postponed "until Congress has had opportunity to further consider the subject of the improvement."

Congress having in the intervening session of 1892–'93 taken no further action regarding it, by authority from the Chief of Engineers of December 29, 1892, the plant and property pertaining to the improvement have been sold to other improvements in the district and the proceeds of such sales, together with the balance of the appropriation, have been covered into the Treasury.

July 1, 1892, balance unexpended	$7,834.74
Received from sales	444.89
	8,279.63
June 30, 1893, amount expended during fiscal year	194.86
July 1, 1893, balance unexpended	8,084.77
July 1, 1893, outstanding liabilities	34.74
July 1, 1893, balance available	8,050.03

(See Appendix L 1.)

2. Roanoke River, North Carolina.—When the United States commenced this improvement, in 1872, navigation by vessels of 10 feet draft was embarrassed by the wreck of a gunboat 6 miles above the mouth of the river and by war obstructions at two other points 9 and 13 miles above its mouth. The river was also somewhat obstructed for that draft by snags in the channel and by leaning trees 67 miles to Indian Highland Bar; thence 62 miles up to Weldon its channel depth on the bars was not less than about 5 feet during about eight months annually, affording a continuous low-water navigation of not more than 2 or 3 feet, and its channel was badly obstructed by snags, logs, stumps, and leaning and overhanging trees.

The original project of 1872 is to secure at all seasons of the year an unobstructed channel with a least width of 50 feet from the mouth 129 miles to Weldon, with a low-water depth of 5 feet from Hamilton 67 miles to Weldon, and to clear the natural channel of snags and artificial obstructions from the mouth 62 miles to Hamilton to the depth requisite for vessels navigating the North Carolina sounds, which draw not more than 8 feet, by removing the war obstructions, snags, fallen and overhanging trees, sand bars and ledges by dredging, the construction of training dikes, and blasting, at an estimated cost, at the high prices of that time, of $269,000.

To June 30, 1892, $131,120.65 had been expended upon the improvement.

At that date the natural-channel depth was not less than 10 feet from the mouth 67 miles to Indian Highland Bar at extreme low water, and was, at ordinary low water, not less than 5 feet thence 62 miles to

Weldon, except upon sand bars 150 feet long at Spring Gut, 21 miles above Hamilton, about 1,600 feet long at Halifax, 57 miles above Hamilton, and about 800 feet long, 1¼ miles below Weldon, and upon a ledge of rock about 2,800 feet in length, extending from old Weldon Ferry up to old Weldon Landing, the depth at these four localities being about 4 feet at ordinary low water, assumed at the zero of the Weldon gauge.

For about 25 of the 44 miles between Jamesville and Hamilton navigation was very considerably obstructed by overhanging trees and by snags, and from a point about 7 miles above Hamilton up to a point about 43 miles above it trimming of about 12½ miles of bank was needful; otherwise the river was in good navigable condition.

With the amount applied during the fiscal year ending June 30, 1893, the channel for the greater part of the 25 miles most obstructed below Hamilton has been entirely cleared, and 17¼ miles of single bank has been cleared to the width of 20 feet.

July 1, 1892, balance unexpended	$7,138.42
Amount appropriated by act approved July 13, 1892	50,000.00
	57,138.42
June 30, 1893, amount expended during fiscal year	12,309.28
July 1, 1893, balance unexpended	44,829.14
July 1, 1893, outstanding liabilities	1,301.11
July 1, 1893, balance available	43,528.03

(See Appendix L 2.)

3. Pasquotank River, North Carolina.—When the United States began this improvement, in 1891, the river had a wide channel nowhere less than 9½ feet deep in calm weather and 8 feet in northerly winds, from Albemarle Sound up. 17 miles to Elizabeth City, and a narrower but good channel, but little obstructed, not less than 7 feet deep 13 miles farther up to the entrance to the Dismal Swamp Canal at the lower end of Turners Cut; thence about 5 miles to the original terminus of the canal and upper end of Turners Cut in a tributary, the Moccasin Track, 1,100 feet above its confluence with the river the natural depth was not less than 5 feet, the channel very sinuous and badly choked with snags and stumps and obstructed by overhanging trees, and above the Moccasin Track the river was likewise choked and obstructed.

The original project of 1889 was first to clear the 5 miles of channel in the river and Moccasin Track from the lower end of Turners Cut to the original terminus of the canal to permit boats passing through the canal to avoid Turners Cut, which had shoaled; and, second, to clear out the river 6 miles farther to Lebanon Bridge for navigation by pole or flat boats, at an estimated cost of $9,000.

By letter of August 3, 1892, the Chief of Engineers authorized the application of $3,000 appropriated by act of July 13, 1892, to be restricted to the removal of such obstructions from the channel below the lower mouth of Turners Cut as interfere with boats of the draft, about 3 feet, that can be carried through the canal, because as great a draft can be carried through Turners Cut, because boats traversing the canal continued to use Turners Cut in preference to the sinuous and longer route in the river and Moccasin Track where a practicable channel had been cleared for them in 1891, and because of the very little commerce, merely by flat or pole boats, in the river above.

The sum of $2,416.15 had been expended to June 30, 1892.

At that date there was a channel in the river and Moccasin Track from the lower end of Turners Cut up to the original terminus of the

canal practicable for, but not used at all by, the boats traversing the canal, the Moccasin Track and a channel 60 feet wide in the river for the 2½ miles next below being thoroughly cleared, and fairly cleared the other 2½ miles down to the lower end of Turners Cut. Below Turners Cut the boats which navigate the canal met with some obstructions in the channel.

By the application of the amount expended during the fiscal year ending June 30, 1893, those obstructions have been removed and there is now, for boats of the draft that can navigate the canal, an unobstructed channel in the river up to the entrance to the canal at the lower mouth of Turners Cut.

July 1, 1892, balance unexpended	$589.85
Amount appropriated by act approved July 13, 1892	3,000.00
	3,589.85
June 30, 1893, amount expended during fiscal year	2,081.02
July 1, 1893, balance unexpended	1,508.83
July 1, 1893, outstanding liabilities	6.00
July 1, 1893, balance available	1,502.83
Amount (estimated) required for maintenance	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix L 3.)

4. Mackeys Creek, North Carolina.—When the United States began to improve it in 1892 the depth was only 7 feet in the somewhat circuitous channel on the shoal at the mouth of the creek in Albemarle Sound.

The project of 1889 was to dredge a straight channel 9 feet deep, 100 feet wide, and about 2,100 feet long through the shoal, modified in May, 1892, by increasing the width of the channel to 140 feet.

To June 30, 1892, $12,061.03 had been expended upon this improvement. At that date the project had been nearly finished and a depth of 9 feet had been obtained on the shoal in the channel from the river to the sound.

With the amount, $6,388.51, expended during the fiscal year ending June 30, 1893, the project was completed, and a channel obtained 9 feet deep, 140 feet wide, and 2,250 feet in length through the shoal.

July 1, 1892, balance unexpended	$6,992.06
June 30, 1893, amount expended during fiscal year	6,388.51
July 1, 1893, balance unexpended	603.55
July 1, 1893, outstanding liabilities	104.59
July 1, 1893, balance available	498.96

(See Appendix L 4.)

5. Ocracoke Inlet, North Carolina.—In 1828, when the United States began to improve the inlet, vessels drawing 9 feet could cross the ocean bar and enter the inlet at low water, but the channel, through the shoals immediately within the inlet, into Pamlico Sound was not practicable for vessels drawing more than 5 feet.

In 1837 the sum of $133,732.40 was expended, producing an increase of 3½ feet in the depth of one of the channels to Pamlico Sound and "a material increase in the number of vessels seeking this outlet from North Carolina ports to the sea," but the shoaling of the dredged chan-

nel and destruction of a jetty constructed to prevent it led to the abandonment of the improvement.

In 1891, when the inlet was surveyed preparatory to resuming its improvement with the sum of $90,000 appropriated by the act of September 19, 1890, the depth in the channel on the bar was not less than 14 feet at mean low water, and on the inner shoals was 7 feet in the channel then navigated and 5 feet in the channel selected for improvement.

The project of 1889 is to dredge a channel 300 feet wide and about 6,000 feet long through the inner shoals, at an estimated cost, if 10 feet deep, of $100,000; if 13 feet deep, of $190,000; and if 15 feet deep of $280,000, with the possible construction of necessary protecting dikes, at an additional cost of $320,000, aggregating $600,000.

To June 30, 1892, $2,225.84 had been expended.

At that date the channel to be improved on the inner shoals had been surveyed and contract for dredging to the amount of $75,000 had been entered into and extended, but dredging had not commenced.

With the amount expended during the fiscal year ending June 30, 1893, a supplemental survey has been made of the inner shoals, but no dredging has been done.

July 1, 1892, balance unexpended		$87,869.72
Amount appropriated by act approved July 13, 1892		15,000.00
		102,869.72
June 30, 1893, amount expended during fiscal year		2,992.87
July 1, 1893, balance unexpended		99,876.85
July 1, 1893, outstanding liabilities	$5.00	
July 1, 1893, amount covered by uncompleted contracts	75,000.00	
		75,005.00
July 1, 1893, balance available		24,871.85
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		495,000.00

(See Appendix L 5.)

6. Fishing Creek, North Carolina.—From its confluence with the Tar River, 56 miles above Pamlico Sound, for about 50 miles up to Bellamys Mill, Fishing Creek averages about 75 to 100 feet wide, and has a channel of good practicable width for small steamboats. September 19, 1890, when the first appropriation was made for its improvement the controlling channel depth on its bars was 3 feet at the average high-water stage of winter and spring. From its mouth, about 17 miles to Savages Bridge, the channel was more or less obstructed by submerged snags; for the lower and greater part of the 25 miles thence to the vicinity of the Wilmington and Weldon Railroad Bridge it was obstructed by many submerged snags and by large masses of trees and logs, forming in many places dense barricades spanning the creek and making its descent slow and tedious in a skiff.

From the railroad bridge about 8 miles up to Bellamys Mill the channel was impracticable on account of its sinuous character around a short ledge of rock, masses of rock projecting from the concave bank at six sharp bends, many leaning trees, and more or less submerged snags. In summer the channel depth is but a few inches.

The project of 1889, is "to clear out its natural obstructions from its mouth up to Bellamys Mill at a total expense of about $25,000."

No money has been expended upon its improvement to June 30, 1893, and the subject is reported to Congress with special report of May 31, 1893.

July 1, 1892, balance unexpended	$10,000.00
Amount appropriated by act approved July 13, 1892	5,000.00
	15,000.00
July 1, 1893, balance unexpended	15,000.00
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	10,000.00

(See Appendix L 6.)

7. *Pamlico and Tar rivers, North Carolina.*—(One river, called the Pamlico below and the Tar above Washington.) When the United States began to improve it, in 1877, its channel was obstructed in two places below Washington by piles; just below Sparta by scuttled lighters; 1 mile below Tarboro by the wreck of a steamer; immediately below Washington by a bar with a depth of 5 feet at low water on its crest in the channel; between Washington and Tarboro the available depth exceeded 2 to 3 feet not more than eight months annually, and above Washington the entire river was more or less obstructed by snags, logs, and stumps in its channel and by trees overhanging from its banks.

The project is that adopted in 1875 to secure by dredging and removal of war obstructions a clear and safe channel 9 feet deep at low water up to Washington, extended in 1879 to clear a channel 60 feet wide, 3 feet deep at low water 22 miles farther to Greenville, and 20 inches deep at low water 26 miles farther to Tarboro; again extended in 1889 to clear the river to its natural dimensions 40 miles farther to Little Falls, 2 miles below Rocky Mount, by removal of war obstructions, snags, logs, stumps, and overhanging trees, at a total final cost estimated in 1891 at $137,200.

To June 30, 1892, $75,724.85 had been expended upon this work.

At that date vessels could carry 7 feet of water at all seasons up the Pamlico 39 miles to Washington, whence 48 miles to Tarboro there was, for boats of 4 feet draft, an intermittent navigation of a variable duration of seven to nine months annually, less intermittent and of longer continuance to Center Bluff and Greenville, 31 and 22 miles above Washington. At ordinary low water of three to five months' duration annually boats could draw 2½ feet to Greenville and Center Bluff, 20 inches to Tarboro, and about 18 inches to Little Falls.

Vessels occasionally struck stumps and snags in the channel for about 3 miles below Washington, between which and Greenville boats were annoyed by snags and overhanging trees, of both of which the river was well cleared from Greenville to Tarboro, whence a practicable channel was cleared to Rocky Mount.

With the amount applied during the fiscal year ending June 30, 1893, the channel has been cleared of snags, logs, and stumps, and the banks of overhanging trees from a point 2 miles above Greenville down 24 miles to Washington, and 6,700 feet of the channel below Washington has been cleared of stumps to the depth of 9 feet, so that vessels can safely draw 8 feet of water at all seasons.

July 1, 1892, balance unexpended	$3,107.82
Amount appropriated by act approved July 13, 1892	10,000.00
	13,107.82
June 30, 1893, amount expended during fiscal year	9,541.41
July 1, 1893, balance unexpended	3,566.41
July 1, 1893, outstanding liabilities	492.97
July 1, 1893, balance available	3,073.44

Amount (estimated) required for completion of existing project	$49,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 7.)

8. Contentnia Creek, North Carolina.—When the United States began to improve it, in 1881, it was badly choked with fallen timber, snags, logs, and stumps; also obstructed by sand bars, and navigation rendered exceedingly difficult, in many places next to impossible, by the dense overhanging growth.

The project of 1881 is, by clearing it of these obstructions, to obtain, from its confluence with the Neuse 63 miles to Stantonsburg, a depth of not less than 3 feet during the higher stages of about nine months' duration annually, at a cost, estimated in 1888, at $77,500.

To June 30, 1892, $49,789.45 had been expended upon this work.

At that date a practicable channel had been moderately cleared 31 miles up to Snowhill and roughly cleared 32 miles farther to Stantonsburg.

During the fiscal year ending June 30, 1893, the channel has been cleared to the above depth from Snowhill to a point 21 miles below that town.

July 1, 1892, balance unexpended	$2,247.65
Amount appropriated by act approved July 13, 1892	7,000.00
	9,247.65
June 30, 1893, amount expended during fiscal year	5,752.42
July 1, 1893, balance unexpended	3,495.23
July 1, 1893, outstanding liabilities	1,109.64
July 1, 1893, balance available	2,385.59

Amount (estimated) required for completion of existing project	18,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 8.)

9. Trent River, North Carolina.—When the United States began to improve it, in 1879, the river was comparatively free from obstructions from Newbern 18 miles to Pollocksville, between which points a draft of 6 feet could be carried at low water. Above Pollocksville it was obstructed by bars of sand and rock, and especially by great numbers of snags in the 11 miles from Lower Quaker Bridge up to Trenton. One steamer ran regularly to Pollocksville, and one occasionally 9 miles farther to Lower Quaker Bridge, above which point navigation was confined to flatboats and rafts.

The project of 1879 was to secure a channel 3 feet deep at low summer stage from Pollocksville above Trenton by removing all obstructions and dredging a cut 50 feet wide through the shoals at a cost estimated in 1887 at $59,000.

In 1889 the project was extended to remove obstructions to permit navigation by small steamboats 33 miles to Trenton, and by pole boats 6½ miles farther to Upper Quaker Bridge, at an additional cost of $13,000, the two projects aggregating $72,000.

To June 30, 1892, $54,916.78 had been expended upon this work.

At that date the channel had been cleared of snags, etc., and the banks of overhanging trees from the mouth to Trenton, and fairly

cleared 7 miles above that point; a channel 3 feet deep at low water and 50 to 75 feet wide had been dredged through the shoals between Pollocksville and Trenton; a turning basin had been dredged and revetted at Trenton, and a channel dredged to the depth of 8 feet and width of 100 feet through Foys Flats, 6 miles above Newbern. But steamers, which the improvement had enabled to make regular trips to Trenton, had again been prevented from ascending to it by shoals which had reformed between the first and third miles immediately below that place.

With the amount applied during the fiscal year ending June 30, 1893, the shoals below Trenton have been surveyed and the clearing of snags which had accumulated between Pollocksville and Lower Quaker Bridge has been commenced.

July 1, 1892, balance unexpended	$608.72
Amount appropriated by act approved July 13, 1892	5,000.00
	5,608.72
June 30, 1893, amount expended during fiscal year	446.50
July 1, 1893, balance unexpended	5,162.22
July 1, 1893, outstanding liabilities	425.24
July 1, 1893, balance available	4,736.98
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	11,500.00

(See Appendix L 9.)

10. Neuse River, North Carolina.—When the United States began to improve it, in 1878, the minimum channel depth during nine months annually was 9 feet from the mouth 40 miles up to Newbern, 4 feet thence 50 miles to Kinston, 3 feet 46 miles farther to Goldsboro, and 2 feet thence 53 miles to Smithfield. Between Newbern and Kinston there were long stretches of shoals, upon at least one of which the depth at the low-water season was only about 18 inches. The channel was obstructed at two points below Newbern and at two between Newbern and Kinston by inclined iron-pointed spars and boxes or vessels or cribs filled with stones. From Contentnia Creek up 119 miles to Smithfield the river was badly obstructed by overhanging trees and by dense masses of logs and snags in the channel.

The project of 1871, as modified or extended in 1878, 1879, 1880, and 1883, is to remove the war obstructions, to clear the channel to Smithfield of all snags, logs, and overhanging trees, to contract the channel way by jetties so as to insure during the entire year an unobstructed 8-foot navigation to Newbern, a similar 4-foot navigation to Kinston, and during nine months annually a 3-foot navigation to Smithfield, at a total final estimated cost of $374,000.

To June 30, 1892, $258,799.08 had been expended upon this work.

At that date there was a good navigable channel 8 feet deep to Newbern, but between Newbern and Kinston there were nine shoals over which not more than 2 feet could be carried at ordinary low water. As regards snags and leaning trees the channel up to Kinston was in good navigable condition.

With the amount applied during the fiscal year ending June 30, 1893, the plant has been thoroughly renovated and the shoals between Newbern and the mouth of the Contentnia have been surveyed for the location of jetties for their improvement.

July 1, 1892, balance unexpended	$8,724.82
Amount appropriated by act approved July 13, 1892	15,000,00
	23,724.82
June 30, 1893, amount expended during fiscal year	2,810.27
July 1, 1893, balance unexpended	20,914.55
July 1, 1893, outstanding liabilities	949.97
July 1, 1893, balance available	19,964.58
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	91,500.00

(See Appendix L 10.)

11. Inland waterway between Newbern and Beaufort, N. C.—(Via Neuse and Clubfoot rivers, Clubfoot and Harlowe Canal, and Harlowe and Newport rivers to Beaufort Harbor.) When the United States began to improve it, in 1885, the shallow part from the Neuse River to Beaufort Harbor was navigable by boats 15 feet wide with 3 feet draft.

The project of 1884 is to obtain a channel 30 feet wide at bottom and 5 feet deep at mean low water from the Neuse River to Beaufort Harbor by dredging in Clubfoot, Newport, and Harlowe rivers and by improvement of the canal at a cost estimated in 1886 at $92,000.

To June 30, 1892, $27,130.98 had been expended upon this work.

At that date a channel 13,000 feet long, 30 feet wide, and 5 feet deep at mean low water had been dredged through the worst portions of Harlowe River, obtaining as good a channel as that in the canal, through which vessels could draw about 3½ feet.

During the fiscal year ending June 30, 1893, the natural channels have been cleared of logs, but vessels drawing about 3½ feet encounter them in passing through the canal which is owned by the Newbern and Beaufort Canal Company.

July 1, 1892, balance unexpended	$7,870.02
June 30, 1893, amount expended during fiscal year	158.84
July 1, 1893, balance unexpended	7,711.18
July 1, 1893, outstanding liabilities	127.64
July 1, 1893, balance available	7,583.54
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	57,000.00

(See Appendix L 11.)

12. Harbor at Beaufort, N. C.—When its improvement by the United States (begun in 1836) was resumed in 1881 the erosion of Fort Macon and Shackleford Points and widening of the entrance between them caused serious shoaling of the channel on and inside the bar, across which there was then a mid-channel depth of not less than 15.3 feet at low water. Within the harbor from the Bulkhead Channel a draft of only 2 feet at low water could be carried to the wharves at Beaufort.

The project of 1881, as modified in 1887 and 1891, is to stop the erosion of the points by jetties, to prevent the shoaling of the channel and harbor, and to dredge a channel 100 feet wide and 7 feet deep at mean low water from the Bulkhead Channel, about 1,800 feet long, to the wharves at Beaufort, at a cost estimated in 1887 at $163,000.

To June 30, 1892, $128,355.31 had been expended upon this work.

At that date the erosion of Fort Macon and Shackleford Points had been arrested; a cut at least 50 feet wide and 5 feet deep at low water had been dredged from the Bulkhead Channel to the wharves at Beaufort, and its widening to 100 feet and deepening to 7 feet were in progress.

With the amount, $11,310.32, applied to the improvement during the fiscal year ending June 30, 1893, the channel to the wharves has, for a distance of 1,895 feet, been widened to 100 feet and deepened to at least 7 feet, but, owing to a shoal at the junction of the Bulkhead Channel with the main channel leading to the harbor entrance, only 6 feet can be carried to the wharves at Beaufort at low water.

July 1, 1892, balance unexpended	$14,046.95
Amount appropriated by act approved July 13, 1892	10,000.00
	24,046.95
June 30, 1893, amount expended during fiscal year	11,310.32
July 1, 1893, balance unexpended	12,736.63
July 1, 1893, outstanding liabilities	159.00
July 1, 1893, balance available	12,577.63
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	13,000.00

(See Appendix L 12.)

13. Inland waterway between Beaufort and New River, N. C.—When the first appropriation was made in 1886 there were in the 28 miles from Beaufort to Swansboro six shoals aggregating about 4 miles in length, over which not more than 18 inches could be carried at low water. Elsewhere the channel was not less than 3 feet deep. From Swansboro 22 miles to New River the route followed intricate tidal sloughs varying from 1,000 to 12 feet in width and 10 feet to 6 inches in depth at high water.

The project adopted in 1885 embraced only that part of the route from Beaufort to Swansboro, which is the more important, and is to obtain a channel of the minimum depth of 3 feet and width of 100 feet by dredging through all the shoals, at an estimated cost of $50,000.

To June 30, 1892, $29,951.74 had been expended upon this work for this purpose.

At that date a channel 45 feet wide and not less than 3 feet deep at low water had been obtained by dredging through six shoals, aggregating 4 miles in length, but at three localities, aggregating about 1,900 feet between shoals, which had been dredged, a draft of only 2½ feet could be carried.

The amount expended during the fiscal year ending June 30, 1893, has been applied to surveys only.

July 1, 1892, balance unexpended	$1,911.10
Amount appropriated by act approved July 13, 1892	10,000.00
	11,911.10
June 30, 1893, amount expended during fiscal year	2,210.93
July 1, 1893, balance unexpended	9,700.17
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 13.)

14. Inland waterway between New River and Swansboro, N. C.—When the first appropriation was made, September 19, 1890, for its improvement, the crooked and intricate bayou which this waterway follows, 22 miles through the marshes between the mainland and outlying sand banks, had, at low water, a minimum depth of about 6 inches upon the shoals or "divides" where the tides meet between the four inlets to it from the ocean, and varied from 12 to 1,000 feet in width.

The project of 1889 is to dredge a channel 40 feet wide and 4 feet deep at high water through the shoals at a cost estimated in 1891 at $52,000.

To June 30, 1892, $509.76 had been spent in surveying the shoals.

To this date, June 30, 1893, no other work has been done, because the Wrightsville and Onslow Navigation Company claims to control the waterway under an act of the State of North Carolina of February 13, 1889. (See House Ex. Doc. No. 26, Fifty-second Congress, first session; also page 1147, Annual Report, Chief of Engineers, 1892.)

July 1, 1892, balance unexpended	$4,382.25
July 1, 1893, balance unexpended	4,382.25
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	38,000.00

(See Appendix L 14.)

15. New River, North Carolina.—In 1886, when the United States began to improve it around the marsh, commencing about 1½ miles within the bar, there was a narrow and circuitous channel about 7,000 feet in length and somewhat crooked in places, between beds of oyster rock, with two short shoals upon which the depth was only about 3 feet. Across the bar and, with the exception of these shoals, from the bar to Jacksonville, 23 miles above it, a draft of 5 feet could be carried.

In 1882 a project was adopted to improve the 7,000 feet of channel around the marsh by straightening, widening it to 150 feet, and deepening it to 5 feet, at an estimated cost of $23,000 to $40,000.

In 1885 the project was changed to dredge a straight channel 4 feet deep at mean low water, 150 feet wide, and about 5,710 feet long, through Cedar Bush Marsh instead of improving the channel around it; also in place of the channel around Wrights Island to dredge a channel of the above width and depth 1,200 feet in length through it.

To June 30, 1892, $19,780.15 had been expended upon this work.

At that date a channel 40 feet wide and 4 feet deep had been dredged 5,800 feet long through Cedar Bush Marsh, and 90 to 100 feet wide, 4 feet deep, and 1,200 feet long through Wrights Island. The channel at Cedar Bush Marsh had shoaled for a distance of 1,700 feet at its upper end, for 1,000 feet of which distance the average depth was 2½ feet, and for about 100 feet it was only 18 inches at low water.

The cut through Wrights Island had scoured to the width of 100 feet and depth of 7 to 16 feet, but at its two ends and at the lower end of Cedar Bush Marsh cut shoals had formed upon which there was only 2 to 3 feet of water at low tide. The natural channel around Wrights Island had narrowed to the minimum width of about 50 feet, but a draft of 5 feet could be carried through it and a draft of 3 feet through the natural channel around Cedar Bush Marsh.

The amount expended during the fiscal year ending June 30, 1893, has been applied to surveys only.

July 1, 1892, balance unexpended	$8,221.85
Amount appropriated by act approved July 13, 1892	5,000.00
	13,221.85
June 30, 1893, amount expended during fiscal year	664.20
July 1, 1893, balance unexpended	12,557.65
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	7,000.00

(See Appendix L 15.)

16. North East (Cape Fear) River, North Carolina.—When the United States began to improve it in 1890 a draft of at least 6 feet could be carried up 48 miles to Bannermans Bridge at lowest stage. From Bannermans Bridge 55 miles up to Kornegays Bridge the river is so shallow its navigation even by flatboats is not usually practicable for any periods of considerable duration, but is dependent upon freshet stages and therefore intermittent at all seasons of the year. Above Bannermans Bridge it was badly obstructed by snags and overhanging trees.

The project of 1889 is to clear the channel to its natural depth and to a good width for small light-draft steamers up to Hallsville and for pole boats up to Kornegays Bridge, at an estimated cost of $30,000.

To June 30, 1892, $3,843.71 had been expended upon this improvement.

At that date the channel to its natural depth and to a width of 40 feet had been cleared merely of its worst obstructions to a high-water navigation from Bannermans Bridge up 31½ miles to Chinquepin.

With the amount applied during the fiscal year ending June 30, 1893, the channel and banks of the lower 4¾ miles of the most obstructed part of the river have been cleared from Rafting Oar to the vicinity of Coxs Bluffs.

July 1, 1892, balance unexpended	$1,191.79
Amount appropriated by act approved July 13, 1892	5,000.00
	6,191.79
June 30, 1893, amount expended during fiscal year	1,265.94
July 1, 1893, balance unexpended	4,925.85
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L 16.)

17. Black River, North Carolina.—When the United States began to improve this river in 1887 the channel from the mouth 24 miles to Point Caswell was fairly cleared to a depth not less than 4 feet at low summer stages, and was roughly cleared 62 miles farther to Lisbon with a least channel depth of 2½ feet at low stage in the 10 miles from Point Caswell to Haws Narrows; thence 52 miles to Lisbon the depth at low summer stage was 18 inches to 3 feet on the shoals and 10 to 12 feet in the pools.

The project of 1885 is to apply at least $10,000 to removing logs, snags, and overhanging trees from the bed and banks, and rounding off a few of the sharpest bends in the river from its confluence with the Cape Fear up 86 miles to Lisbon. In 1893 it was modified to confine the improvement 78 miles up to Clear Run.

To June 30, 1892, $3,000 had been expended upon this work.

At that date navigation was unobstructed from the mouth 34 miles to Haws Narrows, excepting a few trees in the channel and leaning from the banks in the 6 miles next below Point Caswell, and between it and Haws Narrows, through which shoals of sand formed by logs reduced the depth to 18 inches. In the next 14 miles to South River Narrows navigation was not obstructed, but thence 34 miles to Lisbon was badly obstructed by snags, logs, stumps, and overhanging trees.

With the amount expended during the fiscal year ending June 30, 1893, the channel and banks have been cleared from Clear Run down 18 miles.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	3,543.67
July 1, 1893, balance unexpended	6,456.33
July 1, 1893, outstanding liabilities	1,330.90
July 1, 1893, balance available	5,125.43
Amount that can be profitably expended in fiscal year ending June 30, 1895, for maintenance. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

(See Appendix L 17.)

18. Cape Fear River above Wilmington, N. C.—When the United States began to improve it in 1882 a draft of 4 feet could be carried at lowest stages 50 miles above Wilmington to Browns Reach, thence 65 miles to Fayetteville. There were 43 shoals, aggregating about 16⅔ miles in length, on which the depth was not more than 12 to 14 inches during the low stage; from Indian Wells Landing, 37 miles above Wilmington, 78 miles to Fayetteville, the river was badly obstructed by snags, logs, and overhanging trees.

The project of 1881, as matured in 1885 and 1886, is to obtain at all times of the year a depth of 4 feet from Wilmington 73 miles to Elizabethtown, and of 3 feet thence 42 miles to Fayetteville, by removing snags and rock from the bed and overhanging trees from the banks, by contracting the channel by jetties on the shoals, and by a little dredging at a bar of clay, at a total cost, estimated in 1893, of $275,000.

To June 30, 1892, $99,230.31 had been expended upon this work.

At that date navigation from Wilmington to Fayetteville was not materially interfered with by snags, except at two short places and at occasional points where caving of banks had carried trees into the river. Up to Elizabethtown the least channel depth on the shoals at ordinary low water was (from surveys made in 1893) about 2.6 feet and from Elizabethtown up to Fayetteville about 0.8 of a foot.

With the amount applied during the fiscal year ending June 30, 1893, 13 miles of channel have been recleared of snags, 3,619 linear feet of jetties of brush and stone have been built, which have resulted in completely improving three of the worst shoals on the river at and above Elizabethtown, having a total channel length of 2.4 miles, and all the shoals on the river have been surveyed, embracing 28.7 miles of hydrography.

July 1, 1892, balance unexpended	$4,549.99
Amount appropriated by act approved July 13, 1892	15,000.00
	19,549.99
June 30, 1893, amount expended during fiscal year	13,563.83
July 1, 1893, balance unexpended	5,986.16
July 1, 1893, outstanding liabilities	66.36
July 1, 1893, balance available	5,919.80

Amount (estimated) required for completion of existing project.....$156,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix L 18.)

19. Cape Fear River at and below Wilmington, N. C.—The United States began to improve the river between the bar and Wilmington in 1829 and the channel on the bar in 1853. In 1829 the river was so obstructed that vessels drawing more than 10 feet were obliged to anchor 14 miles below Wilmington and discharge a part of their cargoes into lighters. In 1853, at low water on the bar, the least mid-channel depth was 7 feet in the western channel, 7½ feet in the eastern channel, and 8 feet at New Inlet, 7 miles above the mouth.

The original project of 1827 was to deepen the channel through the shoals in the 8 miles next below Wilmington by contracting it by jetties and by diverting into it water from Brunswick River and from Fishing and Rodmans creek.

The project of 1853 was to straighten and deepen the channel on the bar by building jetties and a wing dam, by dredging, by diverting water through it from New Inlet, by building a jetty at Federal Point, and by closing two small breaches in Zekes Island.

The project of 1870 was to deepen the bar channel by closing the breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view.

The project of 1873, to deepen the channel through the bar, added to that of 1870, to dredge in the Baldhead (eastern) Channel, to extend across Zekes Island and beyond it into the river, the dam then being built to close the breaches between Smiths and Zekes islands, and to close New Inlet, commencing with the building of a jetty from Federal Point.

The project of 1874 was "to get 12 feet at low water as high as the city of Wilmington" by dredging a channel 100 feet wide through Horseshoe Shoal below New Inlet and through three other shoals near Wilmington.

The project of 1881 was to dredge a channel 2¾ miles in length through Horseshoe Shoal, and through eight other shoals above it, 270 feet wide and 16 feet deep at mean low water from deep water at Smithville (Southport) to Wilmington.

February 28, 1889, pursuant to a requirement of the river and harbor act of August 11, 1888, the cost of obtaining a channel 20 feet deep at mean low water from Wilmington to the ocean was reported to be $1,800,000. In the Annual Report for 1889 it was reported that an additional appropriation of $25,000 would be required to complete the project of 1881 and obtain a channel 16 feet deep from Wilmington to the ocean. By the river and harbor act of September 19, 1890, Congress appropriated $170,000 for improving the Cape Fear River at and below Wilmington, and December 24, 1890, a contract was entered into for dredging to the depth of 20 feet, which commenced at Wilmington January 19, 1891, and ceased at Brunswick River Shoal, 4½ miles below Wilmington, September 7, 1892.

Since September 7, 1892, work has been in progress to obtain a channel through the shoals between Wilmington and the bar and on the latter, 18 feet deep at mean low water.

To June 30, 1892, $2,618,100.14 has been expended upon this work.

At that date the depth on the bar at mean low water was not less than 17 feet, and not less than 16 feet thence to Wilmington for a width

of 270 feet, excepting at Snows Marsh Channel, where the minimum depth was 16 feet and the minimum width 40 feet, and excepting, also, at Lilliput Shoal, 11 miles below Wilmington, where for a distance of 300 feet the minimum depth was 15 feet. The minimum channel depth then was, therefore, 17 feet upon the bar and 15 feet in the river.

With the amount applied during the fiscal year ending June 30, 1893, the channel 20 feet in depth has been increased in length 812 feet at Brunswick River Shoal, and a channel 18 feet deep and 37 to 74 feet wide has been cut through Brunswick River, Midnight, and Reeves Point Shoals, aggregating 3.1 miles in length, and 82,116 cubic yards of material has been redredged by the United States suction dredge *Woodbury*, and by contract from the shoal at Snows Marsh Channel. At high water a vessel has passed down the river drawing 18 feet 3 inches from Wilmington to Southport and thence 20 feet 3 inches over the bar to sea, the rise of tide being 2.5 feet at Wilmington and 4.5 feet at the bar.

July 1, 1892, balance unexpended		$36,350.23
Amount appropriated by act approved July 13, 1892		200,000.00
		236,350.23
June 30, 1893, amount expended during fiscal year		58,295.64
July 1, 1893, balance unexpended		178,054.59
July 1, 1893, outstanding liabilities	$8,726.07	
July 1, 1893, amount covered by uncompleted contracts	126,278.56	
		135,004.63
July 1, 1893, balance available		43,049.96

Amount (estimated) required for completion of existing project	if to 18 feet	400,000.00
	if to 20 feet	1,430,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		400,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix L 19.)

20. Lockwoods Folly River, North Carolina.—When the United States began this improvement in 1892 the depth on the changeable ocean bar was usually 4 feet at low and 8 feet at high water. These depths could be carried at low stages 1½ miles up the channel to a mud flat, over which for 1½ miles the channel depth averaged less than 1 foot at low water. A little above these flats there was a shoal 300 feet long upon which the depth at low water was about 2½ feet, thence about 23 miles by river to Lockwoods Folly Bridge the depth was nowhere less than 5 feet.

The project was adopted in 1887 to dredge a channel through the flats 100 feet wide and 7 feet deep at low water.

To June 30, 1892, $4,964.32 had been expended.

At that date one cut 40 feet wide and 5 feet deep at low water had been dredged the length of 2,530 feet, about one-third of the distance, through the shoal.

The amount, $3,000, appropriated July 13, 1892, being too small to form a contract for dredging at an advantageous rate, the Secretary of War, August 4, 1892, authorized it to be withheld from expenditure for the present, and no work has been done during the fiscal year ending June 30, 1893.

July 1, 1892, balance unexpended	$35.68
Amount appropriated by act approved July 13, 1892	3,000.00
	3,035.68
June 30, 1893, amount expended during fiscal year	10.82
July 1, 1893, balance unexpended	3,024.86
Amount (estimated) required for completion of existing project	32,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix L 20.)

21. Yadkin River, North Carolina.—Its improvement is restricted to a section 33 miles in length, below and between which and its lower part, called the Great Pedee, which is navigable from tide water to near the southern boundary of the State, there intervenes a section of the river 111 miles in length containing many shoals, rapids, and falls which entirely preclude any attempt to make it navigable.

When the United States commenced to improve the section 64½ miles long from the railroad bridge near Salisbury to the foot of Bean Shoal, its navigation was completely obstructed by rock ledges, fishing and mill dams, and numerous shoals, with a greatest depth of 1 foot at ordinary low water on some of its shoals and ledges. The estimated cost of the improvement was $400,000.

The project of 1879 was to secure a minimum depth of 2½ feet at ordinary stages nine months annually throughout the 64½ miles.

The present project, of 1887, is to secure this depth for a distance of 33½ miles only, next above the railroad bridge at Salisbury, at an estimated cost of $107,000.

To June 30, 1893, $101,601.34 had been expended upon this work. At that date it had a channel 40 to 70 feet wide, 2½ feet deep, about 8 months annually, navigated not even by flat and pole boats.

During the fiscal year ending June 30, 1893, no work has been done; the improvement has been stopped by authority of the Secretary of War of November 16, 1892; the plant pertaining to the improvement has been sold, and the proceeds thereof, together with the balance of the appropriation, covered into the Treasury.

July 1, 1892, balance unexpended	$455.82
Received from sales	1,370.28
Amount appropriated by act approved July 13, 1892	5,000.00
	6,826.10
June 30, 1893, amount expended during fiscal year	1,264.83
July 1, 1893, balance unexpended	5,561.27

(See Appendix L 21.)

22. Georgetown Harbor, South Carolina.—This harbor is that part of the Sampit River immediately within the bar at its mouth near the head of Winyaw Bay.

When the United States began to improve it in 1884 there was in the channel on the ocean bar at the mouth of the bay at low water about 8¾ feet and about 12 feet at high water, thence up the bay there was a depth of 13 feet to the bar at the mouth of the Sampit, upon which there was only 9 feet at ordinary low water.

The project of 1881 was to dredge a channel 200 feet wide to the depth of 12 feet at ordinary low water through this shoal or bar to permit vessels to reach the wharves at Georgetown.

To June 30, 1892, $32,141.12 had been expended upon this work.

At that date a channel 12 feet deep had been dredged entirely through the shoal with a minimum width of 130 feet.

With the amount applied during the fiscal year ending June 30, 1893, the project has been completed and there is now a channel 12 feet deep and 200 feet wide entirely through the shoal from Winyaw Bay to Georgetown Harbor.

July 1, 1892, balance unexpended	$374.88
Amount appropriated by act approved July 13, 1892	12,000.00
	12,374.88
June 30, 1893, amount expended during fiscal year	10,103.19
July 1, 1893, balance unexpended	2,271.69

(See Appendix L 22.)

23. Winyaw Bay, South Carolina.—When the United States began to improve it, in 1890, there was at mean low water in the main (southerly) channel on its ocean bar 7 to 9 feet, and in the Bottle (easterly) Channel 6 to 8 feet, of water, both channels being changeable; thence 12 miles to the head of the bay vessels could draw 12 feet at lowest tides.

The project of 1885, as approved by the Board of Engineer Officers in 1888 and by the Chief of Engineers in 1889, is to increase the depth of water in Bottle Channel to about 15 feet at mean low water by building, to the height of 6 feet above that plane, a jetty from North Island 10,700 feet long and a jetty from South Island 17,500 feet long across the main channel to the 15-foot curve, at a total estimated cost of $2,500,000.

To prevent the overflow to the depth of about 1 foot at mean high water of a wide expanse of marsh on the southerly side of the entrance to the bay, ensuing from the degradation of about 3 miles of beach, and hurtful changes to the tidal regimen of the bay, a dike 10,900 feet in length is to be built, at an estimated cost of $31,000, by authority from the Chief of Engineers of May 10, 1892.

To June 30, 1892, $186,975.79 had been expended upon this work.

At that date the north jetty had been built to a distance of 2,090 feet from the shore and height of 18 inches above mean low water.

With the amount applied during the fiscal year ending June 30, 1893, the north jetty has been extended with a height of 18 inches above mean low water 130 feet, and to a less height, gradually diminishing down to the thickness of the mattress ballast, 1,337 feet farther, to a distance of 3,557 feet from the shore. There has been no increase in depth on the bar since the jetty was commenced.

July 1, 1892, balance unexpended		$66,125.39
Amount appropriated by act approved July 13, 1892		100,000.00
		166,125.39
June 30, 1893, amount expended during fiscal year		98,655.20
July 1, 1893, balance unexpended		67,470.19
July 1, 1893, outstanding liabilities	$21,249.07	
July 1, 1893, amount covered by uncompleted contracts	36,044.60	
		57,293.67
July 1, 1893, balance available		10,176.52

Amount (estimated) required for completion of existing project	2,181,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	600,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix L 23.)

24. Removing sunken vessels or craft obstructing or endangering navigation.—The removal of the wreck of the *I. D. Coleman*, which was dangerous to navigation in 8 feet of water in Albemarle Sound, about 14 miles east of Edenton, N. C., was authorized in August and completed in October, 1892, at a cost of $237.67.

The removal of the remainder of the wreck of the steamer *Concord*, sunk in the channel of the Pamlico River, just below Washington, in 1886, consisting of a few ship's knees and bolts, forming a jagged and dangerous obstruction to navigation, was authorized in November and completed in December, 1892, at a cost of $54.20.

The removal of the wreck of the steamer *City of Long Branch*, burned and sunk in the Roanoke River 2 miles below Edenton, N. C., which projected into the channel and formed a dangerous obstruction to navigation, was authorized January 13 and completed March 23, 1893, at a cost of $539.54.

The boiler of a United States gunboat, sunk during the war on the bar at the entrance to the Cape Fear River, was directly on the line to which the best channel across the bar has recently shifted, had 13½ feet of water upon it at mean low water, and was a dangerous obstruction to navigation and to the dredging of the bar by the United States suction dredge *Woodbury*. Its removal was authorized January 3 and completed June 27, 1893, at a cost of $2,601.02.

(See Appendix L 24.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. W. S. Stanton, Corps of Engineers, and reports thereon submitted through the division engineer, Col. William P. Craighill, Corps of Engineers.

1. Potohunk River, North Carolina.—Maj. Stanton submitted report of examination under date of January 17, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 207, Fifty-second Congress, second session. (See also Appendix L 25.)

2. Durhams Estuary, North Carolina, from mouth to village of Edwards Mill.—Maj. Stanton submitted report of examination under date of November 22, 1892. It is his opinion and that of the division engineer, concurred in by this office, that this stream is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 99, Fifty-second Congress, second session. (See also Appendix L 26.)

3. Breakwater to protect town of Beaufort, N. C.—Maj. Stanton submitted report of examination under date of February 13, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this locality is not worthy of improvement by the General Government in the manner proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 246, Fifty-second Congress, second session. (See also Appendix L 27.)

IMPROVEMENT OF WACCAMAW AND LUMBER RIVERS, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

This district was in the charge of Capt. Frederic V. Abbot, Corps of Engineers; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Waccamaw River, North Carolina and South Carolina.—In 1880 this river was navigable for boats of 12 feet draft at all stages of water from Georgetown 23 miles to Bull Creek, and at high water 4 miles farther to Buck's lower mills; thence for boats of 7 feet draft at high water 22 miles farther to Conway; thence it possessed an obstructed channel for boats of 3 feet draft at ordinary winter water 68 miles to Reeves Ferry; thence an obstructed channel with 3 feet depth at high water 30 miles to Lake Waccamaw.

The project provides for a channel 12 feet deep at all stages of water and 80 feet bottom width from the mouth of the river to Conway; thence a cleared channel to Lake Waccamaw. The estimated cost is $138,400.

The work of the year has been snagging. Up to June 30, 1893, $83,098.70 has been spent, giving a thoroughly cleared channel with 100 feet least width, 7 feet deep at low water as far as Conway, and 40 feet width and 3 feet deep 68 miles above Conway.

The commerce of the year amounts to 70,796 tons.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	5,198.70
July 1, 1893, balance unexpended	4,801.30
July 1, 1893, outstanding liabilities	436.84
July 1, 1893, balance available	4,364.46
Amount (estimated) required for completion of existing project	50,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 1.)

2. Lumber River, North Carolina and South Carolina.—The river was obstructed by logs, snags, and overhanging trees, and in places by sand bars. It was crossed by a number of bridges without draws. The project contemplates the removal of snags, logs, overhanging trees, etc., for 70 miles below Lumberton, at an estimated cost of $35,000. The work of the year has been snagging. The railroad bridge in South Carolina is now being supplied with a steel draw.

The North Carolina bridges have been provided with drawspans or discontinued. The commerce of the year amounts to 7,154 tons. Total expenditures to June 30, 1893, $13,067.96.

July 1, 1892, balance unexpended	$496.62
Amount appropriated by act approved July 13, 1892	5,000.00
	5,496.62
June 30, 1893, amount expended during fiscal year	3,564.58
July 1, 1893, balance unexpended	1,932.04
July 1, 1893, outstanding liabilities	239.25
July 1, 1893, balance available	1,692.79
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 2.)

3. Little Pedee River, South Carolina.—This river was much obstructed by snags and overhanging trees, and in places was subdivided into several branches. The project contemplates providing for steamboat navigation to Lumber River and pole-boat navigation to Little Rock. The estimated cost is $50,000. All bridges on that part of river improved for steamers have been supplied with draws.

The work of the year has been snagging. This year's commerce amounts to 6,153 tons. Total expenditures to June 30, 1893, $12,583.86.

July 1, 1892, balance unexpended	$307.12
Amount appropriated by act approved July 13, 1892	5,000.00
	5,307.12
June 30, 1893, amount expended during fiscal year	2,890.98
July 1, 1893, balance unexpended	2,416.14
July 1, 1893, outstanding liabilities	151.75
July 1, 1893, balance available	2,264.39
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

(See Appendix M 3.)

4. Great Pedee River, South Carolina.—The river was dangerously obstructed by snags and logs. The project provides for thoroughly cleared 9-foot navigation 52 miles to Smith Mills, and 3½-foot navigation to Cheraw, 172 miles above the mouth, at all stages of water, at an estimated cost of $117,000. The work of the year has been snagging. This year's commerce amounts to 94,661 tons. Total expenditures to June 30, 1893, $83,321.72.

July 1, 1892, balance unexpended	$3,857.39
Amount appropriated by act approved July 13, 1892	10,000.00
	13,857.39
June 30, 1893, amount expended during fiscal year	7,679.11
July 1, 1893, balance unexpended	6,178.28
July 1, 1893, outstanding liabilities	669.10
July 1, 1893, balance available	5,509.18
Amount (estimated) required for completion of existing project	27,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	27,500.00

(See Appendix M 4.)

5. Clark River, South Carolina.—This river forms the southern mouth of Lynch River. Its upper end was entirely choked by driftwood and fallen trees. The project provides for closing the northern mouth of Lynch River and snagging Clark River. The estimated cost is $7,500. The work of the year has been snagging. All that is needed before Lynch River is opened for steamers has been done.

This year's commerce amounts to 7,628 tons. Total expenditures to June 30, 1893, $7,086.19.

Amount appropriated by act approved July 13, 1892	$2,500.00
June 30, 1893, amount expended during fiscal year	2,086.19
July 1, 1893, balance unexpended	413.81
July 1, 1893, outstanding liabilities	56.00
July 1, 1893, balance available	357.81

(See Appendix M 5.)

6. Mingo Creek, South Carolina.—This stream was much obstructed by snags and overhanging trees. The project provides for removing obstructions from the mouth to Williams Landing for steamboat navigation and above for pole-boat navigation. The estimated cost is $17,000. The work of the year has been snagging. This year's commerce amounts to 94,665 tons. Total expenditures to June 30, 1893, $11,546.02.

July 1, 1892, balance unexpended	$515.13
Amount appropriated by act approved July 13, 1892	3,000.00
	3,515.13
June 30, 1893, amount expended during fiscal year	2,061.15
July 1, 1893, balance unexpended	1,453.98
July 1, 1893, outstanding liabilities	76.20
July 1, 1893, balance available	1,377.78
Amount (estimated) required for completion of existing project	4,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	4,000.00

(See Appendix M 6.)

7. Santee River, South Carolina.—This river was obstructed by sunken logs and snags. The bar was narrow, crooked, and shifting, with only about 4 feet depth at low tide. The project provides for leaving the Mosquito Creek Canal, which has been completed for about $100,000, as a lumber route, and for a new cut between Estherville and Minim Creek at an estimated cost of $250,000, and for completely snagging the Santee River itself at a cost of $100,000. During the past year dredging on the new canal continued till September 30, when it was suspended during the building of a new and powerful dredge by the United States. A new and better right of way was secured by purchase.

Up to June 30, 1893, $143,559.63 has been spent in giving a passage 30 feet wide and 5 feet deep at high water from Santee River to Winyah Bay, in building a drawbridge over Mosquito Creek, in replacing damaged rice drainage, and dredging on the new Estherville–Minim Creek Canal. This year's commerce amounts to 124,182 tons.

July 1, 1892, balance unexpended	$16,409.49
Amount appropriated by act approved July 13, 1892	30,000.00
	46,409.49
June 30, 1893, amount expended during fiscal year	30,369.12
July 1, 1893, balance unexpended	16,040.37
July 1, 1893, outstanding liabilities	9,234.41
July 1, 1893, balance available	6,805.96
Amount (estimated) required for completion of existing project	290,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	200,000.00

(See Appendix M 7.)

8. Waterce River, South Carolina.—This river had a low-water depth of from 3 to 4 feet from its mouth 67 miles to Camden. It was much obstructed by snags and by two railroad bridges without draws. The project provides for 4-foot steamboat navigation to Camden. Total expenditures to June 30, 1893, $59,454.34.

The appropriation of September 19, 1890, completes the original estimated cost and for this sum the river has been put into a satisfactory condition. The engineer officer in charge reports that an annual appropriation of $6,500 is needed for maintenance. This year's commerce amounts to 6,242 tons.

July 1, 1892, balance unexpended	$6,822.77
Amount appropriated by act approved July 13, 1892	2,500.00
	9,322.77
June 30, 1893, amount expended during fiscal year	6,277.11
July 1, 1893, balance unexpended	3,045.66
July 1, 1893, outstanding liabilities	302.82
July 1, 1893, balance available	2,742.84
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893	6,500.00

(See Appendix M 8.)

9. Congaree River, South Carolina.—This river had a low-water depth of from 3 to 4 feet from its mouth 48 miles to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther. The lower 47 miles from Granby to the mouth was blocked by snags and a railroad bridge without a draw. The 3 miles above Granby was impassable, being rapids. The project provides for 4-foot navigation below Granby and a cleared channel through the rapids above. The work of the year has been snagging. Total expenditures to June 30, 1893, $21,992.26. This year's commerce amounts to 2,781 tons.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	1,992.26
July 1, 1893, balance unexpended	3,007.74
July 1, 1893, outstanding liabilities	429.34
July 1, 1893, balance available	2,578.40
Amount (estimated) required for completion of existing project	29,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix M 9.)

10. Charleston Harbor, South Carolina.—The work in progress since 1878 comprises two jetties of riprap with a mattress hearting, wherever deemed advantageous, resting upon a mattress of logs and brush. The jetties spring from Sullivan and Morris islands and converge on curves so as to cross the bar on parallel lines about 2,900 feet apart. They are to establish and maintain a channel across the bar not less than 21 feet deep at low water, where heretofore the low-water depth has not exceeded 12 feet. Estimated cost for jetties up to low water $4,380,500; up to 3 feet above mean low water $5,334,500.

Dredging was resumed with United States dredge and hired labor on July 18 and continued till October 15, when all the Government plant was turned over to the contractors under the new continuing contract. Dredging and stonework from that time till the end of the year was all done by contract, and was practically continuous.

Reasonable prices were secured on the first letting and a contract for $1,300,000 was entered into with Messrs. Egan and Friday on October 4. The United States have the right to extend this contract at same

prices till the total amount authorized by act of July 13, 1892, has been expended, or to close it at any time after the $1,300,000 has been spent. During the year 159,556 tons of stone was deposited on the jetties, and 325,222 cubic yards of material dredged.

No settlement of the jetties has occurred during the year.

About 1¾ miles of the south jetty and 1¾ miles of the north jetty have been raised to high water.

The annual survey shows marked deepening between the jetties and for some distance beyond their outer ends. There is now a good channel way through with 15 feet of water at low tide. Total expenditures to June 30, 1893, $2,546,214.67.

July 1, 1892, balance unexpended		$16,685.64
Amount appropriated by act approved July 13, 1892		225,000.00
Amount appropriated by sundry civil act approved March 3, 1893		750,000.00
		991,685.64
June 30, 1893, amount expended during fiscal year		360,400.31
July 1, 1893, balance unexpended		631,285.33
July 1, 1893, outstanding liabilities	$94,233.03	
July 1, 1893, amount covered by uncompleted contracts	885,405.62	
		979,638.65
Amount (estimated) required for completion of existing project		1,203,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		750,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix M 10.)

11. Ashley River, South Carolina.—The plan of improvement comprised the removal of a shoal about 8 miles above the city of Charleston, S. C., where there was only 9 feet of water at low tide, and another just below the Wando Phosphate Works, where there was only 6 feet. Low-water depth of from 10 to 11 feet with widths of from 100 feet to 200 feet have been obtained, and a balance is left for maintenance. This year's commerce amounts to 465,000 tons. Total expenditures to June 30, 1893, $5,497.19.

July 1, 1892, balance unexpended	$826.34
June 30, 1893, amount expended during fiscal year	823.53
July 1, 1893, balance unexpended	2.81
July 1, 1893, outstanding liabilities	2.81

(See Appendix M 11.)

12. Wappoo Cut, South Carolina.—The project provides for a channel 60 feet wide and 6 feet deep at low water between Ashley and Stono rivers. There is now a narrow 6-foot channel all the way through. This year's commerce amounts to 141,000 tons. Total expenditures to June 30, 1893, $50,284.28.

July 1, 1892, balance unexpended	$2,583.23
Amount appropriated by act approved July 13, 1892	10,000.00
	12,583.23
June 30, 1893, amount expended during fiscal year	9,867.51
July 1, 1893, balance unexpended	2,715.72
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 12.)

13. Edisto River, South Carolina.—The river was much obstructed by snags and shoals. The project provides for a channel for rafts and flatboats from the sea, 260 miles, to Guignard Landing on the South Fork, at an estimated cost of $33,385. The work of the year has been snagging. The project has been satisfactorily completed for less than the estimated cost.

This year's commerce amounts to 129,125 tons. Total expenditures to June 30, 1893, $32,935.85.

July 1, 1892, balance unexpended	$172.26
Amount appropriated by act approved July 13, 1892	7,385.00
	7,557.26
June 30, 1893, amount expended during fiscal year	7,108.11
July 1, 1893, balance unexpended	449.15

(See Appendix M 13.)

14. Salkahatchie River, South Carolina.—The river was much obstructed by snags. The project provides for a continuous flatboat channel from 5 miles above Toby Bluff to Hickory Hill, at an estimated cost of $18,000. This year's commerce has amounted to 16,000 tons. The last appropriation completes the estimated cost and no further funds will be required, the improvement being completed and a sufficient balance being left for maintenance. Total expenditures to June 30, 1893, $14,241.66.

July 1, 1892, balance unexpended	$4,517.07
June 30, 1893, amount expended during fiscal year	758.73
July 1, 1893, balance unexpended	3,758.34

(See Appendix M 14.)

15. Beaufort River, South Carolina.—The portion to be improved is near Coosaw River, where there was only about 4 feet depth at low water for a short distance. A through channel 7 feet deep has been provided by dredging as projected. The estimated cost is $40,000. The total expenditures to June 30, 1893, have been $24,937.23. The amount appropriated was not sufficient to give the required width, as more rock was encountered than was anticipated. As recommended by the district engineer, the original estimate has been increased by $15,000. This year's commerce amounts to 250,000 tons.

July 1, 1892, balance unexpended	$2,915.05
Amount appropriated by act approved July 13, 1892	12,500.00
	15,415.05
June 30, 1893, amount expended during fiscal year	15,352.28
July 1, 1893, balance unexpended	62.77
July 1, 1893, outstanding liabilities	37.70
July 1, 1893, balance available	25.07
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation.—Three wrecks in the upper branches of the Cooper River were removed. A wreck was reported in the Ashley River draw of the Charleston and Savannah Railroad Bridge, but was subsequently

removed by its owners. The schooner *Kate V. Aitken* was wrecked about 800 feet north of the jetty channel, Charleston Harbor, South Carolina. She was advertised and contract, amounting to $4,745, made for her removal. No work had been done on her at the close of the fiscal year.

The expenditures during the year amounted to $1,029.41.

(See Appendix M 16.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *Lynch River, South Carolina*, required by act of July 13, 1892, was made by the local engineer, Capt. Frederic V. Abbot, Corps of Engineers, and report thereon, dated December 2, 1892, submitted through the division engineer, Col. William P. Craighill, Corps of Engineers. It is the opinion of Capt. Abbot and of the division engineer, concurred in by this office, that the river is worthy of improvement to the extent indicated in the report. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $600. The report was transmitted to Congress and printed as House Ex. Doc. No. 125, Fifty-second Congress, second session. (See also Appendix M 17.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA.

This district was in the charge of Capt. O. M. Carter, Corps of Engineers, with Lieut. Thomas H. Rees, Corps of Engineers, under his immediate orders to March 31, 1893; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. Savannah Harbor, Georgia.—The plan of improvement under which operations have been carried on in Savannah Harbor during the last fiscal year was approved by the Secretary of War on July 22, 1890. The project contemplates the establishment of a navigable channel 26 feet deep at mean high water between the city of Savannah and Tybee Roads. The mean rise and fall of tides varies from about 7 feet at Fort Pulaski to about 6 feet in front of the city wharves.

The estimated cost of the improvement is $3,500,000.

In 1873, prior to improvement, the channel was in places not more than 9 feet deep at mean low water, and the usual high-water draft of vessels was not more than 14.5 feet.

Prior to July 1, 1892, there had been placed in the work under the present project 72,178.84 square yards of log and brush mattresses, 29,583.05 cubic yards of stone, 54,794.58 cubic yards of brush fascines, 3,273 piles and 44 clusters of fender piles, making a total of 3,405 piles; and there had been removed from the channel by dredging 432,315.16 cubic yards of material.

The river and harbor act approved July 13, 1892, contained an appropriation of $318,750 for continuing this improvement, with the following provisions:

Provided, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the present project of improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two million eight hundred and thirty-one thousand two hundred and fifty dollars, exclusive of the amount herein and heretofore appropriated.

A contract was entered into with P. Sanford Ross, of Jersey City, N. J., for all of the dredging and with the Atlantic Contracting Company, of New York, for all of the other work required for the improvement.

During the fiscal year just closed there were used in the pile and brush work forming the training walls below Spirit Island, the spur-dams protecting the banks at Elba and Jones Island, and the Duck Puddle closing dam, 62,859.47 cubic yards of brush fascines; 66,186.93 square yards of brush mattresses; 2,972.75 cubic yards of riprap stone; 302,027.60 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, and 33,399.1 pounds of iron bolts for fastening the timber to the pile work; there were driven 2,571 piles, 268 groups of tie piles, and 7 clusters of fender piles, making a total of 3,128 piles. There were put into the lower-flats training wall 829.18 cubic yards of fascines, 174,522.02 square yards of brush mattresses, and 5,082.34 cubic yards of riprap stone.

Between the Ocean Steamship Company's wharves and Tybee Knoll 488,518.68 cubic yards of material has been removed by dredging.

The total amount expended under the present project to June 30, 1893, including all outstanding liabilities, is $827,669.48.

There is now a navigable channel from the city to the sea with a mean low-water depth of 15.5 feet, a gain of about 6.5 feet since the the work was begun.

The real gain in navigable depth is somewhat greater than here shown, and vessels of from 21 to 22 feet draft now go from the city to the sea on a single tide.

The estimated reduction in freight rates, due to the improvements already executed, is 25 per cent, which effects an annual saving in freights alone of more than the total sum of money expended by the United States upon the harbor within the last twenty-five years.

July 1, 1892, balance unexpended		$8,563.75
Amount appropriated by act approved July 13, 1892		318,750.00
Amount appropriated by sundry civil act approved March 3, 1893		1,000,000.00
		1,327,313.75
June 30, 1893, amount expended during fiscal year		327,211.55
July 1, 1893, balance unexpended		1,000,102.20
July 1, 1893, outstanding liabilities	$154,986.63	
July 1, 1893, amount covered by uncompleted contracts	819,705.12	
		974,691.75
July 1, 1893, balance available		25,410.45

Amount (estimated) required for completion of existing project	1,831,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N 1.)

2. Savannah River, Georgia.—The present project for the improvement of this river was adopted in 1890, the object being to secure a low-water steamboat channel not less than 5 feet in depth between the cities of Augusta and Savannah, Ga.

The estimated cost of the improvement is $332,000. Prior to improvement navigation was much impeded by logs, snags, piles, and other

obstructions. The depth at summer low water over some of the shoals did not exceed 2 or 3 feet.

The total amount expended under the present project to June 30, 1892, including all outstanding liabilities, was $24,076.75, and resulted in removing 354 snags, stumps, and logs, and 3,443 overhanging trees from the most troublesome places throughout the whole extent of the river. Five trees were swung to bank, and 24 logs were cut up on bank. Seven spur-dams were constructed for the protection of caving banks below the city of Augusta, and some of the old dams were repaired. There were placed in this work 4,861.40 cubic yards of brush fascines, and 3,352.47 cubic yards of stone.

The expenditures during the year ending June 30, 1893, including all outstanding liabilities, amounted to $10,028.60.

There have been removed from the river during the present fiscal year 2,619 snags and stumps; 8,495 overhanging trees and projecting logs were cut and removed from the banks.

July 1, 1892, balance unexpended		$943.16
Amount appropriated by act approved July 13, 1892		35,000.00
		35,943.16
June 30, 1893, amount expended during fiscal year		9,919.57
July 1, 1893, balance unexpended		26,023.59
July 1, 1893, outstanding liabilities	$109.03	
July 1, 1893, amount covered by uncompleted contracts	20,000.00	
		20,109.03
July 1, 1893, balance available		5,914.56

Amount (estimated) required for completion of existing project	272,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	75,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 2.)

3. Savannah River above Augusta, Ga.—The present project for the improvement of this part of Savannah River is outlined in report of Capt. O. M. Carter, Corps of Engineers, dated January 31, 1890, and adopted in 1892. It contemplates the establishment of a pole-boat channel between Petersburg, Ga., and the Locks, above Augusta, Ga., 12 to 25 feet wide and navigable at ordinary summer low water for boats drawing 2 feet. This is to be accomplished by the removal of sand shoals, ledges of rock or gravel, and overhanging trees, and by the construction of spur dams and training walls to maintain the depth of the improved channel.

The estimated cost of the improvement is $33,000.

Prior to July 1, 1892, there was no work done under the present project.

During the fiscal year just closed there were new dams built, old ones repaired and extended, and rock excavated from the channel at the following places: Stevens Creek Falls, Half Way Ledge, Four Mile Reach, Pine Log Shoals, Scotts Shoal, and Chicken Sluice. There were used in this work 2,018.66 cubic yards of fascines, 1,186.30 cubic yards of riprap stone, and 200 pounds of explosives. There was excavated from the channel 341.5 cubic yards of rock, and the river banks were cleared from The Locks, above Augusta, Ga., to Petersburg, Ga., a distance of 48 miles.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	5,819.92
July 1, 1893, balance unexpended	4,180.08
July 1, 1893, outstanding liabilities	4,136.72
July 1, 1893, balance available	43.36
Amount (estimated) required for completion of existing project	23,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	23,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 3.)

4. Darien Harbor, Georgia.—The plan of improvement under which operations have been carried on in Darien Harbor during the last fiscal year was adopted in 1885. The project contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy. The mean rise and fall of this tide is about 6.5 feet.

The estimated cost of the improvement is $170,000.

No work was ever done under the existing project prior to the fiscal year ending June 30, 1891.

The total amount expended under the present project to June 30, 1891, including all outstanding liabilities, is $24,321.97.

During the fiscal year just closed there were constructed 20 spur dams for the improvement of the upper river, in the construction of which there have been used 15,068.35 cubic yards of brush fascines, 59,290.25 feet, B. M., of 6 by 10 inch timber, and 6,094.46 pounds of iron bolts. There were driven 1,075 piles, 4 groups of tie piles, and 39 clusters of fender piles, making a total of 1,200 piles.

The total expenditures under the present project of improvement to June 30, 1893, including all outstanding liabilities, amounted to $49,546 68.

July 1, 1892, balance unexpended	$733.03
Amount appropriated by act approved July 13, 1892	25,000.00
	25,733.03
June 30, 1893, amount expended during fiscal year	25,175.59
July 1, 1893, balance unexpended	557.44
July 1, 1893, outstanding liabilities	104.12
July 1, 1893, balance available	453.32
Amount (estimated) required for completion of existing project	120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	120,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 4.)

5. Altamaha River, Georgia.—The plan of improvement under which operations have been carried on upon the Altamaha River during the last fiscal year was adopted in 1890.

The project contemplates the establishment of a steamboat channel 3 feet in depth at ordinary summer low water between Darien and the junction of the Oconee and Ocmulgee rivers.

The estimated cost of the improvement is $129,000.

Prior to improvement navigation was much impeded by logs, snags, and other obstructions, the low-water depths at some points not exceeding 2 feet.

The total amount expended under the present project to June 30, 1891, including all outstanding liabilities, was $2,446.79, and resulted

in removing many of the most dangerous snags and overhanging trees. Since then and up to June 30, 1892, there were removed 521 snags and 1,011 overhanging trees, and 8 logs were cut up. At Beards Bluff 1,231 linear feet of wattled-pile spur dams were constructed and the old training wall was repaired.

The total expenditures under the present project up to June 30, 1892, including all outstanding liabilities, amounted to $8,369.11.

During the fiscal year just closed there were constructed at Couper Bar a training wall and 3 spur dams, aggregating 932 feet in length, in the construction of which there were used 4,390.11 cubic yards of brush fascines, 141.51 cubic yards of riprap stone, 12,502.25 feet, B. M., of 6 by 10 inch timber, as waling, cross and back ties, and 1,285.40 pounds of iron bolts for fastening the timber to the pile work. There were driven 471 piles, 26 groups of tie piles, and 11 clusters of fender piles, making a total of 556 piles.

Besides the above work, which was done by contract, the following work was done by hired labor: Old work at Beards Bluff was repaired and 12 new spur dams, 6 new closing dams, and 79 linear feet of shore protection were built at Marrowbone Bar. In this work there were used 231 piles, 1,630 cubic yards of brush mattresses, 230 cubic yards of riprap stone, and 1,252 linear feet of wattling.

There were removed from the river during the fiscal year 24 snags and stumps and 1,305 overhanging trees. Sixteen logs were cut up on bank. In this work there was used 148 pounds of explosives.

The total expenditure during the fiscal year ending June 30, 1893, including all outstanding liabilities, amounted to $18,323.89.

July 1, 1892, balance unexpended	$7,140.66
Amount appropriated by act approved July 13, 1892	15,000.00
	22,140.66
June 30, 1893, amount expended during fiscal year	17,925.87
July 1, 1893, balance unexpended	4,214.79
July 1, 1893, outstanding liabilities	398.02
July 1, 1893, balance available	3,816.77
Amount (estimated) required for completion of existing project	99,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 5.)

6. Oconee River, Georgia.—The plan of improvement under which operations have been carried on upon the Oconee River during the last fiscal year was adopted in 1890.

The project contemplates the establishment of a steamboat channel 3 feet in depth at ordinary summer low water between Milledgeville and the mouth of the river.

The estimated cost of the improvement is $171,000.

Prior to improvement navigation was much impeded by sand bars, overhanging trees, snags, and sunken logs. On some shoals there were low-water depths of not more than 2 feet.

Prior to July 1, 1892, there were removed under the present project 1,719 logs, snags and stumps, 16,804 overhanging trees, and 366.5 cords of drift; 116 trees were girdled and 166 logs were cut up; there was placed in the closing dam at Fish Trap Cut 600 cubic yards of stone.

In building spur dams at Old Boat Yard there were driven 165 piles; 935 linear feet of piling was wattled with poles, and 991 linear feet of brush mattresses, 18 feet wide, was sunk. A new snag boat, the *Satilla*, was completed October 3, 1891.

The total amount expended under the present project to June 30, 1892, including all outstanding liabilities, is $22,403.61.

During the fiscal year just closed there have been removed from the channel 1,588 snags and stumps, 81 overhanging trees, and 61 logs were cut up on the river bank, which work has resulted in putting the channel from the Central Railroad bridge to 11½ miles above it in a good, navigable condition.

July 1, 1892, balance unexpended	$2,797.82
Amount appropriated by act approved July 13, 1892	25,000.00
	27,797.82
June 30, 1893, amount expended during fiscal year	10,635.39
July 1, 1893, balance unexpended	17,162.43
July 1, 1893, outstanding liabilities	225.15
July 1, 1893, balance available	16,937.28
Amount (estimated) required for completion of existing project	121,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 6.)

7. *Ocmulgee River, Georgia.*—The plan of improvement under which operations have been carried on upon the Ocmulgee River during the last fiscal year was adopted in 1890. The project contemplates the establishment of a steamboat channel 3 feet in depth at ordinary summer low water between Macon and the mouth of the river.

The estimated cost of the improvement is $210,000.

Prior to improvement navigation was much impeded by rock shoals, sand bars, overhanging trees, snags, and sunken logs, the low-water depth at some places not exceeding 2 feet.

The total amount expended prior to June 30, 1891, including all outstanding liabilities, was $13,099.69, and resulted in removing many dangerous obstructions, boats now being able to run without accident at a stage of water some 3 feet lower than before the improvements were begun.

Since then and up to June 30, 1892, there were removed from the river 2,912 snags and stumps and 6,756 overhanging trees; 19 trees were girdled and 66 logs were cut up on the bank. The total amount expended under the present project up to June 30, 1892, including all outstanding liabilities, is $28,205.77.

During the fiscal year just closed the works at Tillmans Bar were thoroughly repaired, and one new spur dam, as well as 278 linear feet of bank protection, was built at this place. In this work there were driven 124 piles, and there were used 1,163 cubic yards of brush mattresses, 1,112 cubic yards of riprap stone, 2,085 poles, 20 feet by 3 inches, for wattling, 94,332 feet, B. M., 12 by 12 inch timber, and 2,500 pounds of iron spikes. There was also excavated 1,080 cubic yards of material for the construction of the shore protection. The work done during the fiscal year has resulted in putting the channel from the mouth to Macon in good condition and in giving a least depth of 4.7 feet across Tillmans Bar.

July 1, 1892, balance unexpended	$2,039.18
Amount appropriated by act approved July 13, 1892	25,000.00
	27,039.18
June 30, 1893, amount expended during fiscal year	15,080.55
July 1, 1893, balance unexpended	11,958.63
July 1, 1893, outstanding liabilities	496.03
July 1, 1893, balance available	11,462.60

Amount (estimated) required for completion of existing project	155,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 7.)

8. Brunswick Harbor, Georgia.—The plan of improvement under which operations have been carried on in Brunswick Harbor during the last fiscal year was adopted in 1880, and modified and enlarged in 1886.

The project contemplates the establishment of a navigable channel not less than 15 feet deep at mean low water. The mean rise and fall of tide is 6.8 feet.

The cost of the project of 1880 was estimated at $73,187.50, and as enlarged in 1886 at $190,000, inclusive of appropriations already made.

In 1880, prior to improvement, the channel was not more than 9 feet deep at mean low water.

During the fiscal year just closed there was removed from the channel by dredging 29,933.1 cubic yards of material, and there were put into the training wall 3,866.15 cubic yards of brush fascines and 412.06 cubic yards of riprap stone.

The amount expended to June 30, 1893, including all outstanding liabilities, is $180,918.92, and has resulted in securing a navigable low-water channel not less than 15 feet deep.

July 1, 1892, balance unexpended		$882.04
Amount appropriated by act approved July 13, 1892		27,500.00
		28,382.04
June 30, 1893, amount expended during fiscal year		11,130.91
July 1, 1893, balance unexpended		17,251.13
July 1, 1893, outstanding liabilities	$8,170.05	
July 1, 1893, amount covered by uncompleted contracts	8,769.69	
		16,939.74
July 1, 1893, balance available		311.39

(See Appendix N 8.)

9. Brunswick Outer Bar, Georgia.—The act of Congress approved July 27, 1892, provided for payments to Mr. C. P. Goodyear, upon his procuring a channel of certain widths and depths within periods specified across the outer bar at Brunswick, Ga., north of the present channel, by the explosion of dynamite on or beneath the bottom of the channel. The examinations made by the local engineer showed that the depths, 22 and 23 feet, required by the act to be obtained by November 1, 1892, and January 1, 1893, were not secured. By act of March 1,

1893, the time for procuring the various channel depths was extended to November 1, 1893. Correspondence in the matter and the reports of the local officer upon the inspections of the work done are submitted as Appendix N 9.

10. Jekyl Creek, Georgia.—The plan of improvement under which operations have been carried on in Jekyl Creek during the last fiscal year was adopted in 1888. The project contemplates the establishment of a navigable channel through the creek 7 feet deep at mean low water. The mean rise and fall of the tide is about 7.1 feet.

The estimated cost of the improvement is $38,590.

Prior to improvement the low-water depth at some places did not exceed 3 feet.

During the fiscal year just closed there were put into the training wall at the mouth of Jekyl Creek 17,170.97 square yards of brush mattresses and 1,252.51 cubic yards of riprap stone, extending the jetty to nearly 1,500 feet from the angle point. The least depth across the bar now is 5½ feet.

The expenditures during the year, including all outstanding liabilities, amounted to $22,300.76, of which $7,363.07 was on account of Jekyl Creek, and $14,937.69 on account of the Inside Water Route from Savannah, Ga., to Fernandina, Fla. (See below.)

The total amount expended to June 30, 1893, including all outstanding liabilities, is $34,748.77, of which $19,811.08 was on account of the improvement of Jekyl Creek, and has resulted in securing a navigable channel with a low-water depth of not less than 5½ feet.

July 1, 1892, balance unexpended	$51.99
Amount appropriated by act approved July 13, 1892	7,500.00
	7,551.99
June 30, 1893, amount expended during fiscal year	3,729.79
July 1, 1893, balance unexpended	3,822.20
July 1, 1893, outstanding liabilities	3,633.28
July 1, 1893, balance available	188.92

Amount (estimated) required for completion of existing project	18,590.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	18,590.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil acts of March 3, 1893.	

(See Appendix N 10.)

11. Cumberland Sound, Georgia.—The plan of improvement under which operations have been carried on at Cumberland Sound during the last fiscal year was adopted in 1879, and revised in 1891. The project contemplates the establishment of a navigable channel across the bar 19 feet deep at mean low water. The mean rise and fall of tide is 5.9 feet. The estimated cost of the improvement is $2,079,500, exclusive of work done prior to 1891.

Prior to improvement the low-water depth of the entrance varied from 11 to 12.5 feet, with a mean rise and fall of tide of 5.9 feet.

During the fiscal year just closed there were placed in the north jetty 107,734.92 square yards of brush mattresses and 13,683.63 cubic yards of riprap stone, extending from the foundation course 3,698.6 feet, the second course 6,896.4 feet, and the third course 94.9 feet. The total amount expended to June 30, 1893, including all outstanding liabilities, is $761,914.92.

July 1, 1892, balance unexpended	$2,123.09
Amount appropriated by act approved July 13, 1892	170,000.00
	172,123.09
June 30, 1893, amount expended during fiscal year	171,367.82
July 1, 1893, balance unexpended	755.27
July 1, 1893, outstanding liabilities	170.19
July 1, 1893, balance available	585.08
Amount (estimated) required for completion of existing project	1,817,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 11.)

12. Inside water route between Savannah, Ga., and Fernandina, Fla.—The existing project of improvement, submitted in report of survey dated November 25, 1891, provides for the establishment of a channel 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla.

The estimated cost of the improvement is $105,000, provided that amount may be made at once available.

An appropriation of $15,000, the first for this work, was made by the river and harbor act approved July 13, 1892.

In its present condition, the channel depth is less than 5 feet in some places.

No work was done prior to the present fiscal year, during which work was entirely confined to Jekyl Creek. (See above.) The depth across the bar at this place now is 5½ feet, as against 4.08 feet before its improvement.

The expenditures during the year, including all outstanding liabilities, amounted to $14,937.69.

Amount appropriated by act approved July 13, 1892	$15,000.00
June 30, 1893, amount expended during fiscal year	346.69
July 1, 1893, balance unexpended	14,653.31
July 1, 1893, outstanding liabilities	14,591.00
July 1, 1893, balance available	62.31
Amount (estimated) required for completion of existing project	90,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	90,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—Proposals for removing the wreck of the Austrian bark *Undine*, lying in Savannah Harbor, Georgia, were opened on June 15 and the contract was awarded to Messrs. Johnston and Townsend, Somers Point, New Jersey, the work of removal to begin early in the next fiscal year. (See Appendix N 13.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *Savannah River, Georgia, between Spirit Island and the point where the Charleston and Savannah Railway crosses said river*, required by act of July 13, 1892, was made by the

local engineer, Capt. O. M. Carter, Corps of Engineers, and report thereon, dated November 14, 1892, submitted through the division engineer, Col. William P. Craighill, Corps of Engineers. It is the opinion of Capt. Carter, and of the division engineer, concurred in by this office, that this locality is worthy of improvement to the extent heretofore recommended and approved. No further survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 50, Fifty-second Congress, second session. (See also Appendix N 14.)

IMPROVEMENT OF RIVERS AND HARBORS IN FLORIDA.

This district was in the charge of Maj. John C. Mallery, Corps of Engineers, to June 20, 1893, and in the temporary charge of Lieut. Albert M. D'Armit, Corps of Engineers, since that date; Division Engineer, Col. William P. Craighill, Corps of Engineers.

1. St. Johns River, Florida.—Operations for the improvement of this river have been carried on in conformity with a project submitted in 1879, by the late Col. Q. A. Gillmore, Corps of Engineers. The plan contemplates the formation of a continuous channel 15 feet deep at mean low water from Jacksonville to the ocean. The points where work is required are in a reach near Dames Point, 12 miles from the mouth, and on the bar at the mouth. Near Dames Point the mean low-water depth varies from 12 to 13 feet, with a tidal range of about 2 feet. The bar at the mouth is formed of sand. Before work began the mean low-water channel depth across it varied from 5 to 7 feet, with a tidal range of 5.8 feet. The channel across the bar shifted continuously north and south through a mile range. The work was divided into two parts: (1) The formation of a channel across the bar at the mouth, by the concentration and direction of the tidal currents by two jetties, to start from the opposite shores of the entrance, and to converge until, on the bar, their outer ends should be approximately parallel and 1,600 feet apart; and (2) the improvement of the Dames Point Reach, by dredging, and the construction of works of protection, under a project approved June 11, 1891, and approved in a modified form March 30, 1892.

As the improvement at the mouth was at first most urgently needed, the five appropriations up to that of 1886, inclusive, aggregating $675,000, were made for improving "the channel over the bar at the mouth," under the estimate for that part of the total project. Since 1887 the depth on the bar has been greater than that in the Dames Point Reach, and the interests of commerce have demanded that the work at the latter point should be started. Accordingly, the appropriations of 1888 and 1890 were made for improving the river "from Jacksonville to the ocean, including the channel over the bar at the mouth," under the estimate for the entire project. The work of improving the channel at Dames Point is now being carried out by means of an appropriation of $300,000 made by Duval County, and the appropriations of 1892 and 1893 were made for improving the channel over the bar at the mouth.

At the close of the fiscal year ending June 30, 1892, $958,595.40 had been expended. The south jetty had a total length of 8,293 feet. Of this, 1,740 feet was built to the full height; 5,600 feet was above mean low water, excepting in a few places which were slightly below it, and the depth over the remaining 953 feet varied from 13 to 18 feet at mean low water. The total length of the north jetty was 10,991 feet, 553 feet

at the inner end and 276 feet about one-half way out was built to the full height and capped; 6,478 feet was at, and in places above, mean low water; 1,050 feet was about 1 foot below mean low water and the remaining 2,634 feet sloped down to a depth of about 10 feet.

Prior to 1886 the jetties were built of alternate layers of mattresses and rock. Since that date mattresses have been used in the foundation course only. Prior to November, 1887, the mattresses consisted of logs and brush and of poles and brush. Since that date they have consisted of brush fascines held together by pole binders.

A survey of the Dames Point Reach was made in 1889 and a survey of the Mile Point Bank in 1892.

Work, by contract, under the appropriation of 1890 was completed December 30, 1892. Under the provisions of the act approved July 13, 1892, a contract was made for the completion of the improvement. Work was begun under the same on April 1, 1893.

During the fiscal year ending June 30, 1893, there were placed in the south jetty 22,894 square yards of mattresses, 3,449 cubic yards of second-class stone, and 8,734 cubic yards of third-class stone; extending the foundation course a distance of 1,685 feet, making the total length of the jetty 9,978 feet, and the jetty was raised in various low places. No work was done on the north jetty during the fiscal year.

The south channel is still the only available one, and has but 10.7 feet on the outer bar. The north jetty channel has deteriorated while the south jetty channel promises to open within a short time as a result of the prolongation of the south jetty. The depth on the inner bar, which was 15½ feet last year, has increased to 18½ feet.

July 1, 1892, balance unexpended		$61,405.48
Amount appropriated by act approved July 13, 1892		112,500.00
Amount appropriated by sundry civil act approved March 3, 1893		284,500.00
		458,405.48
June 30, 1893, amount expended during fiscal year		71,863.53
July 1, 1893, balance unexpended		386,541.95
July 1, 1893, outstanding liabilities	$7,900.88	
July 1, 1893, amount covered by uncompleted contracts	338,509.39	
		346,410.27
July 1, 1893, balance available		40,131.68

(See Appendix O 1.)

2. Upper St. Johns River, Florida.—By the river and harbor act of July 5, 1884, the sum of $5,000 was appropriated for improving the Upper St. Johns River, Florida; this being the first appropriation made for this work.

The stream has sufficient depth for the class of vessels adapted to its navigation, but it is very crooked.

The approved project of 1883 was to establish a straighter channel by suitable cut-offs, to be made 6 feet deep at low-river stage and 100 feet wide at the bottom, at an estimated cost of $38,800.

The work was advertised, but no bids were received on account of the small sum appropriated, and operations were deferred until further appropriations might be available.

On April 2, 1892, the original project was modified so that the money available might be expended in removing the worst points at the bends where cut-offs had been proposed.

A contract was let for the work, and operations began March 16, 1893. The plant provided by the contractors has proven inadequate,

and only 2,006.7 cubic yards had been removed up to the end of June, 1893.

The officer in charge recommends the construction by the United States of a suitable snag and dredge boat, for use in the rivers and harbors of the east coast of Florida, at a cost of $20,000.

July 1, 1892, balance unexpended		$4,930.05
June 30, 1893, amount expended during fiscal year		385.25
July 1, 1893, balance unexpended		4,544.80
July 1, 1893, outstanding liabilities	$822.27	
July 1, 1893, amount covered by uncompleted contracts	3,377.73	
		4,200.00
July 1, 1893, balance available		344.80

Amount (estimated) required for completion of existing project	33,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	33,800.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 2.)

3. Volusia Bar, Florida.—Volusia Bar is situated at the head of Lake George, and is formed of materials brought down by the St. Johns River and deposited at the point where the current of the narrow river loses its velocity as the bed widens to form the lake. The usual depth on the bar, before operations began, was from 3½ to 4½ feet, with a very crooked channel. At times this depth was diminished so much as to stop navigation entirely.

The adopted plan of improvement was to contract the waters on the bar by the construction of two converging jetties formed of brush and stone, with a view to causing a scour to the depth of 6 feet. Should the depth caused by the jetties not be sufficient, recourse was to be had to dredging. Between the jetties on the bar, lines of guide piles were placed to keep vessels off the jetties and to define the channel clearly.

In 1887 it was decided to limit the channel depth sought to the 5 feet then obtained, on account of the evident shoaling in the lake beyond the jetties, and because that depth was sufficient for the requirements of the existing commerce of the river.

Up to June 30, 1892, $25,889.91 had been expended. The jetties had been built to their full length and to a height sufficient to produce the desired effect. Two lines of firmly set fender piles defined the jetty channel on the crest of the bar, and a straight channel with a minimum low-water depth of 5 feet had been obtained. In the spring of 1890 the crests of both jetties were found to have lowered slightly, and several gaps had been made through them, to a depth of 4 feet in one place. One hundred and ninety-seven cubic yards of rock was placed on the jetties, filling the lowest places.

In December, 1889, one of the river steamers broke out one of the panels of the west pile-fender line. The officer in charge reports that, on account of the shoalness of the lake beyond the jetties, any further increase of depth should be attained by dredging from time to time, as may be required. He states that this will require an annual outlay of $500, provided a contract can be made for the work.

Under the appropriation of July 13, 1892, the break in the row of fender piles has been repaired and dredging on the bar will be begun during the summer.

July 1, 1892, balance unexpended		$110.09
Amount appropriated by act approved July 13, 1892		1,000.00
		1,110.09
June 30, 1893, amount expended during fiscal year		47.63
July 1, 1893, balance unexpended		1,062.46
July 1, 1893, outstanding liabilities	$249.84	
July 1, 1893, amount covered by uncompleted contracts	675.00	
		924.84
July 1, 1893, balance available		137.62

Amount (estimated) required for maintenance of existing project	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 3.)

4. Ocklawaha River, Florida.—The portion of the Ocklawaha River which it is proposed to improve lies between Leesburg, on Lake Griffin, and the mouth, a distance of 94 miles. The channel width varies from 30 to 70 feet, and the depth from 5 to 9 feet. From the outlet of Lake Griffin, for a distance of 28 miles, the river is sluggish in current, has numerous bends, and is badly obstructed by floating islands and grass. For the remaining 58 miles the current is strong and the principal obstructions are snags and overhanging trees.

The approved project is to clear the channel between Lake Griffin and the mouth by removing snags and the worst overhanging trees, and by moving the floating islands out of the channel and staking them in place by piles.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1892, was $8,775.69.

Under the appropriation made by act of September 19, 1890, a survey and map of the river were made and the channel was cleared of its worst obstructions from the mouth to the prairie, a distance of 60 miles. A total of 3,881 snags and 705 overhanging trees was removed, and 84 trees were trimmed.

The unprecedented low water developed a few shoals which it appears desirable to have removed, and more effective means being proposed for keeping the channel clear of floating islands. A revised project has been adopted in 1892 calling for an additional expenditure of $15,000. The estimated annual cost for maintenance of the channel is $1,000.

The $1,000 appropriated July 13, 1892, was expended in clearing the river of obstructions. Five hundred and seventy-four snags and 312 overhanging trees were removed, and 14 trees were trimmed. A fairly navigable channel exists at high water as far as the floating islands and at extreme low water as far as the prairie.

July 1, 1892, balance unexpended		$1,224.31
Amount appropriated by act approved July 13, 1892		1,000.00
		2,224.31
June 30, 1893, amount expended during fiscal year		2,222.61
July 1, 1893, balance unexpended		1.70

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 4.)

5. St. Augustine Harbor, Florida.—The approved project is to protect the shores from erosion by the construction of groins of concrete and riprap on brush-foundation mattresses.

Three appropriations, aggregating $65,000, have been made for this harbor, and two of them, amounting to $55,000, have been expended in accordance with this project.

Work under the first appropriation was begun in October, 1889, and ended in September, 1890.

Work under the second appropriation was commenced in December, 1890, and ended in May, 1891.

The amount expended up to June 30, 1892, was $53,720.40.

Five groins in all have been built; one 341 feet long, and another 523½ feet long, on Anastasia Island, near the light-house; one 548.9 feet long, one 465 feet long, and one 415 feet long, on North Beach, near the point.

During the year 1892 a sheet-pile wing dam, 327 feet long, was built on the south side of Groin No. 4.

The shore lines have continued to build out, excepting in the vicinity of Groin No. 4 and on the west side of Groin No. 2, where slight erosions have taken place.

The act of July 13, 1892, appropriated $10,000 for this improvement. With this sum it is proposed to construct two additional groins and some necessary wing walls. Work on these groins is now in progress.

Local changes having occurred, it appeared that the estimate of the existing project would not complete the needed protection, and accordingly a revised estimate has been adopted calling for an additional appropriation of $30,000.

July 1, 1892, balance unexpended	$1,279.60
Amount appropriated by act approved July 13, 1892	10,000.00
	11,279.60
June 30, 1893, amount expended during fiscal year	3,154.63
July 1, 1893, balance unexpended	8,124.97
July 1, 1893, outstanding liabilities	5,008.58
July 1, 1893, balance available	3,116.39
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O 5.)

6. Indian River, Florida.—By act approved July 13, 1892, $15,000 was appropriated for—

Improving Indian River, Florida, between Goat Creek and Jupiter Inlet: *Provided*, That no part of the money appropriated shall be expended until the Florida Coast Line Canal and Transportation Company surrenders and relinquishes to the United States all the rights and privileges which it now holds under State charter along the entire route.

The portion of the river named is about 81 miles in length and the channel is obstructed by numerous shoals with a low-water depth of from 2½ to 4 feet.

The Florida Coast Line Canal and Transportation Company, a company duly incorporated under the laws of the State of Florida, has made a number (23) of dredged cuts across the shoals through this defective reach, making a continuous navigable channel 50 feet wide and 5 feet deep at low water, extending to Jupiter Inlet. The aggre-

gate length of the cuts made by this company is 39,500 feet. Under its charter the company "is authorized to own vessels and navigate the waterway; to levy tolls on its cuts and channels improved; and to operate telegraph and telephone lines." (Prospectus of company, January, 1890.)

Steamers now run daily between Titusville and Melbourne throughout the year, and tri-weekly in summer and daily in winter between Melbourne and Jupiter Inlet. These boats are light-draft stern-wheel steamers with gross tonnage of about 150 tons, with a capacity of from 100 to 130 passengers.

The approved project, submitted in report of examination made to comply with provisions of the river and harbor act approved September 19, 1890, is to make a continuous channel 5 feet deep at low water and 75 feet wide, excepting in the bends, where it may be as wide as may be required.

The approximate estimate of the cost of this work is $44,000.

The canal company not having relinquished its rights and privileges, now held under the charter from the State of Florida, no work has been done.

Amount appropriated by act approved July 13, 1892	$15,000
July 1, 1893, balance unexpended	15,000

(See Appendix O 6.)

7. *Northwest entrance, Key West Harbor, Florida.*—A bar having a channel depth of 10.5 feet obstructs the northern entrance to this harbor. During storms the available depth is so much reduced that vessels bound to and from Gulf ports can not use it, but are compelled to make a detour of about 100 miles by Dry Tortugas to enter or leave the Gulf.

An examination of the entrance, with a view to its improvement, was made in 1867 and again in 1881. In 1882 Congress made an appropriation of $25,000 for dredging a channel 300 feet wide and 17 feet deep across the bar. As was anticipated, the improvement was only temporary.

In the act approved August 5, 1886, $2,500 was appropriated for a new examination and survey of the bar. This was made in December, 1886, and January, 1887. The bar was found to be formed and maintained by interfering tidal currents. The project for its improvement comprised the construction of one or more training walls, with dredging, if necessary.

In the act of August 11, 1888, Congress appropriated $25,000 for this work, with the proviso that the Secretary of War should appoint a board of three engineer officers, who should consider the subject and report on the advisability of continuing the work under the above project, and that he should submit the report, together with the views of himself thereon, to Congress at its next session.

The final report of the board was submitted in November, 1889, and printed as a part of Appendix P 4, Report of the Chief of Engineers, 1890. The board was of the opinion that the work is of national importance. It recommended that the improvement be begun by the immediate construction of a jetty along the northeast side of the entrance.

Up to the close of the fiscal year ending June 30, 1892, $64,881.40 had been expended on the present project.

Work under the appropriation of 1890 was continued until May 12, 1892, when the contract was completed. Twenty-six thousand eight hundred and twenty-one and nine-tenths cubic yards of stone was placed in the jetty during the fiscal year ending June 30, 1892, making a total of 27,982.2 cubic yards in the jetty.

Work under the appropriation of July 13, 1892, was begun June 1, 1893. By June 30, 2,969 cubic yards of stone had been placed in the jetty, extending the foundation layer seaward a distance of 1,028 feet.

During the year the crest of the jetty has been lowered by the action of the waves on an average of 0.5 foot.

The total length of the jetty is 7,916 feet, having a depth over it at mean low water varying from 3½ feet to 11½ feet and averaging 6 feet. There is practically no change in the condition of the channel as reported last year.

July 1, 1892, balance unexpended		$118.60
Amount appropriated by act approved July 13, 1892		75,000.00
		75,118.60
June 30, 1893, amount expended during fiscal year		7,277.74
July 1, 1893, balance unexpended		67,840.86
July 1, 1893, outstanding liabilities	$8,699.05	
July 1, 1893, amount covered by uncompleted contracts	58,139.98	
		66,839.03
July 1, 1893, balance available		1,001.83

Amount (estimated) required for completion of existing project	385,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	385,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 7.)

8. Caloosahatchee River, Florida.—Before improvement the lower part of the river was so obstructed by oyster bars that the available channel depth was only 5½ feet. About 17 miles above the mouth the river loses the characteristics of an estuary, and there are numerous islands and a broad shoal.

The project adopted in 1882 called for the formation by dredging of a channel 100 feet wide and 7 feet deep from the bay to Fort Myers, a distance of 17 miles. In 1886 this project was modified so as to include the improvement of the upper river as far as Fort Thompson by removal of snags and overhanging trees.

Up to June 30, 1892, $27,577.41 had been expended on the improvement. A channel 6 feet deep and 100 feet wide existed between the mouth and Fort Myers. A narrow cut 5 feet deep had been made through the shoals at Beautiful Islands and partially protected by a training wall, and the worst obstructions had been removed from the river as far as Fort Thompson.

Three thousand six hundred dollars was appropriated by the act of September 19, 1890, for completing the improvement. With this sum the remaining obstructions were removed from the channel between Fort Thompson and the Beautiful Islands. The cut at the Beautiful Islands Shoal and its protecting dike were extended, and the channel through the oyster bars at the mouth of the river was enlarged and marked. When work stopped there was a clear channel from the mouth to Fort Thompson, having a mean low-water depth of 6 feet as far as Fort Myers and a depth of 4 feet for the remaining distance. An annual expenditure of $1,000 will be required to maintain this improvement.

The act of July 13, 1892, appropriated $1,000 for this work, which sum is still held available for maintaining the channel, and will be expended in removing fallen trees and a small shoal near Beautiful Island as soon as the services of the snag boat are available.

July 1, 1892, balance unexpended	$22.59
Amount appropriated by act approved July 13, 1892	1,000.00
	1,022.59
June 30, 1893, amount expended during fiscal year	12.70
July 1, 1893, balance unexpended	1,009.89
Amount (estimated) required for maintenance of existing project	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 8.)

9. Charlotte Harbor and Pease Creek, Florida.—The portion under improvement lies between the Boca Grande entrance from the Gulf of Mexico and the wharves at Punta Gorda, 2 miles from the mouth of Pease Creek. The available depth at the entrance is 19 feet at mean low water. Immediately within the entrance there is an anchorage with a depth of 18 feet and over. Between that point and Punta Gorda, a distance of 24½ miles, the channel depth varies from 10 to 20 feet. In the act of September 19, 1890, $35,000 was appropriated for improving the channel between the limits named. A survey of the defective portions of the channel was made, a project was prepared for its improvement, and a contract entered into for doing the work. The approved project contemplates the immediate formation of a channel 12 feet deep and as wide as the funds will permit. The estimated cost of a channel 200 feet wide and 12 feet deep is $127,500; of a channel 200 feet wide and 15 feet deep $468,000.

The amount expended up to June 30, 1892, was $3,223.95.

It was decided to expend the money available in deepening the channel from the wharf at Punta Gorda to Beacon No. 2, a distance of about 10,000 feet. The depth of water in this portion of the channel varied from 10 feet at the wharf to 12 feet at Beacon No. 2. It was estimated that the amount available was sufficient to excavate a channel 300 feet wide for a distance of 300 feet in front of the wharf and 100 feet wide from that point to Beacon No. 2 to a depth of 12 feet.

Work under the contract with the Alabama Dredging and Jetty Company was begun April 17, 1893, and the dredging was completed June 20, 1893.

One hundred and forty-one thousand two hundred and ninety-three cubic yards of material was removed. Of this amount 34,296 cubic yards was dredged in excess of a depth of 13 feet. The work has resulted in the formation of a channel 300 feet wide for a distance of 300 feet in front of the wharf at Punta Gorda; 160 feet wide for a distance of 4,729 feet, and 120 feet wide for a further distance of 1,764 feet, where it connects with the 12-foot contour. The total length of the dredged cut is 6,793 feet. Over nearly the entire area dredged the depth is in excess of 13 feet.

July 1, 1892, balance unexpended	$31,776.05
June 30, 1893, amount expended during fiscal year	20,272.36
July 1, 1893, balance unexpended	11,503.69
July 1, 1893, outstanding liabilities	8,740.00
July 1, 1893, balance available	2,763.69
Amount (estimated) required for completion of existing project	92,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 9.)

10. Sarasota Bay, Florida.—The total length of Sarasota Bay is 34 miles. The portion under improvement extends from Tampa Bay to Sarasota, a distance of 21¼ miles. The general available depth in the channel is 5 feet, but there are two reaches, aggregating 1 mile in length, where the available channel depth varies from 3.5 to 4.3 feet. The approved project contemplates the formation of a channel 100 feet wide and 5 feet deep at mean low water between the limits named above.

The amount expended up to June 30, 1892, was $4,939.73.

Work was begun by the United States snag and dredge boat *Suwanee* October 31, 1891, and discontinued, owing to the exhaustion of funds, February 13, 1892. Four thousand three hundred and sixty-three and a half cubic yards of material (measured in place) was removed, forming a cut 1,673 feet long and 38 feet wide through the shoal near Palma Sola Point.

The $2,500 appropriated by act of July 13, 1892, was expended in repairing the United States steam snag and dredge boat *Suwanee* and continuing the work at Palma Sola Point, resulting in connecting the 5-foot contours by a cut 2,292 feet long, with a width of from 38 to 40 feet, and a depth of from 5 to 6 feet. A further examination of the shoal at Long Bar revealed peculiar difficulties in its removal, and a revised project was approved September 23, 1892, calling for an additional $7,500 for the completion of the improvement.

July 1, 1892, balance unexpended	$60.27
Amount appropriated by act approved July 13, 1892	2,500.00
	2,560.27
June 30, 1893, amount expended during fiscal year	1,982.89
July 1, 1893, balance unexpended	577.38
July 1, 1893, outstanding liabilities	503.74
July 1, 1893, balance available	73.64

Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 10.)

11. Manatee River, Florida.—The portion of the Manatee River under improvement is the lower reach, between Rocky Bluff and the mouth, a distance of about 12 miles. This had a mid-channel depth of from 7 to 20 feet. The general width is about three-fourths of a mile. At the mouth was a long shoal with a minimum depth of 7 feet. Between Palmetto and Manatee, about 6 miles from the mouth, was another bar, covered by from 3 to 5 feet of water.

The river was examined in 1881. The project adopted had for its object to form a channel 100 feet wide and 13 feet deep at mean low water from Tampa Bay to McNeil Point (Palma Sola). Owing to the changed commercial relations since the adoption of the project, brought about by the extension of the railroad to Tampa, the transfer to Tampa of the principal Gulf steamship lines, and the service of the smaller towns around Tampa Bay by coasting steamers from Tampa, the project was modified in 1886 to provide for the passage of these lighter-draft vessels to all of the towns of the lower river by the removal of the bar above Palmetto.

Up to the close of the fiscal year ending June 30, 1892, $27,978.13 had been expended on this improvement. A dredged cut was made

across the bar at the mouth of the river, another cut was made across the bar between Manatee and Braidentown, and a survey and map of the river were made. The cut at the mouth had been nearly obliterated, but a channel 8 feet deep and of sufficient width existed from Tampa Bay to Manatee. By the act approved September 19, 1890, $6,000 was appropriated for continuing the improvement, which amount was supplemented by a further appropriation of $6,000, made by the act approved July 13, 1892. With the $12,000 thus available extensive repairs were made to the United States steam snag and dredge boat *Suwanee*, with a view of better adapting it to this work. It is proposed to dredge a channel 12 feet deep at mean low water, and 100 feet wide, through the bulkhead at Sneads Point. Work was begun in June, 1893. One thousand three hundred and eighty-nine cubic yards (measured in place) was removed, and it is expected that the work will be completed before December, 1893.

Further and larger appropriations will be necessary before work can be begun on the outer bar.

July 1, 1892, balance unexpended	$6,021.87
Amount appropriated by act approved July 13, 1892	6,000.00
	12,021.87
June 30, 1893, amount expended during fiscal year	7,574.58
July 1, 1893, balance unexpended	4,447.29
July 1, 1893, outstanding liabilities	991.64
July 1, 1893, balance available	3,455.65
Amount (estimated) required for completion of existing project	33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 11.)

12. Tampa Bay, Florida.—The harbor at Tampa Bay, at the head of one arm of this bay, was separated from deep water by a flat 2 miles wide. Through this was a narrow channel with an average available depth of about 5 feet, formed by the waters of Hillsboro River.

The original project was adopted in 1879, and had for its object the formation of a 9-foot channel, 150 feet wide in the bay and 200 feet wide in the river, from the 9-foot curve in the bay to the wharves at Tampa, in Hillsboro River.

Up to June 30, 1892, $109,995.36 had been expended. The work consisted entirely of dredging and rock excavation, and extended over a distance of 8,200 feet, making a cut varying in width from 200 feet in the river to 60 feet in the bay. On June 30, 1887, it had a depth along its center line of from 8.3 to 9 feet. The depth on the flats beyond the outer extremity of the cut is 7 feet. In 1888 the project was modified. Port Tampa, 9½ miles from Tampa, on Old Tampa Bay, had become the deep-water port of Tampa. The modified project is to form and maintain a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 20 feet deep and 200 feet wide from the outer bar to Port Tampa. By June 30, 1892, the channel called for by the project had been completed in Old Tampa Bay, and a continuous channel 8 to 9 feet deep and 70 feet wide had been secured from the mouth of Hillsboro River to the 8-foot contour in Hillsboro Bay.

Work under the appropriation made in act of September 19, 1890, was continued until July 31, 1892, when the available funds were ex-

hausted. Work under the appropriation made in act of July 13, 1892, was begun January 9, 1893, and was completed June 3, 1893. During the year 932.2 cubic yards of rock and 30,237.9 cubic yards of sand were removed from the channel. The channel is now 200 feet wide in the river and from 75 to 100 feet wide in the bay.

July 1, 1892, balance unexpended	$10,004.64
Amount appropriated by act approved July 13, 1892	10,000.00
	20,004.64
June 30, 1893, amount expended during fiscal year	16,779.25
July 1, 1893, balance unexpended	3,225.39
July 1, 1893, outstanding liabilities	3,200.71
July 1, 1893, balance available	24.68

(See Appendix O 12.)

13. Withlacoochee River, Florida.—This river is 120 miles long and has a normal width varying from 75 to 180 feet, though at numerous points a defined channel is almost lost in broad marshy lakes and cypress swamps. The low-water depth varied from 1 to 7½ feet. Before improvement the river was so obstructed by shoals, loose rocks, snags, fallen trees, floating grass islands, and bars as to be practically impassable excepting in isolated reaches.

The river was examined with a view to its improvement in 1879. The approved project calls for the removal of snags, overhanging trees, loose rocks, and some of the worst shoals between the Gulf of Mexico and Pemberton Ferry, a distance of about 77 miles, so as to permit boats of 2 feet draft to navigate the river during one-half the year.

Prior to June 30, 1891, the river had been cleared and made navigable, as called for by the project, between Pemberton Ferry and Dunnellon. Work was still required on some of the ledges in order to make navigation safe. Work was also required below Dunnellon.

The amount expended up to June 30, 1892, was $21,049.26.

In the act approved September 19, 1890, $5,400 was appropriated for continuing the improvement. Work under this appropriation was begun March 23, 1892. On account of the very low stage of the river the United States snag and dredge boat *Suwanee* could not be taken up where the work was most required. The boat was laid up and a party formed from the crew, and the work of removing obstructions was carried on from the small boats and from the banks.

During the last fiscal year operations were continued until the money available was exhausted. The channel is now practically clear from Pemberton Ferry to the mouth.

July 1, 1892, balance unexpended	$2,850.74
June 30, 1893, amount expended during fiscal year	2,839.29
July 1, 1893, balance unexpended	11.45

Amount (estimated) required for maintenance of existing project	800.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	800.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 13.)

14. Harbor at Cedar Keys, Fla.—The improvement of this harbor has been carried on from time to time under various appropriations made since 1872. It was obstructed by a shoal, known as the middle ground, lying in the main ship channel opposite War Key, and by shoals elsewhere in the channel and at its outer extremity. At these

points the general channel depth of 12 feet was reduced from 7 or 9 feet by outcropping rocks with sand and shells.

The existing project for the improvement has for its object to form a channel 200 feet wide and 10½ feet deep through these shoals. Work under this project has been carried on under various appropriations made since 1884. The total expenditure up to June 30, 1892, was $21,794.09. A clear channel of the required depth from the gulf up to Cedar Keys had been obtained. Near Buoy No. 12 and in the middle ground the width was insufficient. Some further dredging was done in the middle ground. When work stopped the cut there had a width of 200 feet and a least depth of 9½ feet. Along its east side the depth was 10 feet. In the act approved September 19, 1890, $2,500 was appropriated for this harbor, with the provision that a portion could be expended at Derrick Island Gap on the inside channel from Suwanee River. The project for this portion of the improvement is to obtain a channel 5 feet deep at mean low water from the harbor of Cedar Keys to the Suwanee Basin.

The work was done with the United States steam snag and dredge boat *Suwanee*. When operations ceased, owing to the exhaustion of the appropriation, a channel had been dredged in the vicinity of Derrick Island Gap 1,196 feet long, 37½ feet wide, and 6 feet deep.

There were no operations during the past fiscal year, no funds being available, and further appropriations are not at present recommended, the present commercial requirements being fully met by the existing condition of the harbor, excepting as far as the inside passage between the town of Cedar Keys and the mouth of the Suwanee River is concerned, the channel in the vicinity of Derrick Island Gap being still incomplete.

July 1, 1892, balance unexpended	$205.91
June 30, 1893, amount expended during fiscal year	194.61
July 1, 1893, balance unexpended	11.30
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	44,000.00

(See Appendix O 14.)

15. Suwanee River, Florida.—The length of river under improvement is 130 miles. From the Derrick Gap entrance to Branford, a distance of 80 miles, the width of the river varies from 250 to 300 feet, and its original low-water depth from 3 to 30 feet. It was but little obstructed excepting at the mouth. Between Branford and Ellaville the general width is 325 feet. It was obstructed by many dangerous rock shoals, crossed by crooked channels, which had a low-water depth of from 1.5 to 3 feet, as well as by snags and overhanging trees.

A project for this improvement was adopted in 1880. It contemplates the formation of a channel 150 feet wide and 5 feet deep from the Gulf (through the bars at the passes) as far up the river as New Branford (Roland Bluff). From there to Ellaville the channel is to be 60 feet wide and 4 feet deep.

Up to the close of the fiscal year ending June 30, 1892, $40,761.67 had been expended on this improvement. A long cut, now partly obliterated, had been made through the shoals between the mouth and deep water of the Gulf of Mexico, and a practicable but not safe channel had been opened as far as Hudson.

The channel between Branford and Luraville has been widened and deepened so that a channel, safe during medium and high stages and

fairly safe and 3 feet deep at the lowest stages, now exists as far as Hudson, 15 miles below Ellaville. The channel across the Suwanee basin was partially opened and was marked with palmetto piles.

Operations under the appropriation of $3,000 made in act of July 13, 1892, will be commenced as soon as the services of the United States snag and dredge boat *Suwanee* become available, the boat having undergone extensive repairs with a view to better adapting it to the work along the Gulf coast of Florida.

July 1, 1892, balance unexpended	$238.33
Amount appropriated by act approved July 13, 1892	3,000.00
	3,238.33
June 30, 1893, amount expended during fiscal year	1,880.44
July 1, 1893, balance unexpended	1,357.89
Amount (estimated) required for completion of existing project	21,158.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O 15.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *harbor at Cape Canaveral, Florida*, required by act of July 13, 1892, was made by the local engineer, Maj. J. C. Mallery, Corps of Engineers, and his report thereon, dated September 28, 1892, was submitted through the division engineer, Col. William P. Craighill, Corps of Engineers. It is the opinion of Maj. Mallery, concurred in by this office, that a harbor at Cape Canaveral is worthy of improvement by the General Government. Col. Craighill states that he considers a harbor at this point a very desirable improvement and worthy of being undertaken by the United States, unless the proposed survey should show it to be a work of very great expense out of proportion to the interests involved. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $2,500. The report was transmitted to Congress and printed as House Ex. Doc. No. 54, Fifty-second Congress, second session. (See also Appendix O 16.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

This district was in the charge of Capt. Philip M. Price, Corps of Engineers, with Lieut. William E. Craighill, Corps of Engineers, under his immediate orders; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Apalachicola Bay, Florida.—In 1879 there was a minimum depth of 3½ feet in the channel over the bar at the mouth of the Apalachicola River.

The bar begins about one-half mile below the town of Apalachicola, Fla., and is at about 7,300 feet wide between the 8-foot curves.

In 1879 a plan of improvement was adopted which contemplated dredging through the bar a straight channel 11 feet deep and 100 feet wide, to be afterwards increased to 200 feet should the first cut produce results to warrant it.

In 1891 this project was amended to include dredging a straight channel through Bulkhead Shoal 9 feet deep and not less than 100 feet wide.

Up to June 30, 1892, the sum of $106,951.32 had been expended on this improvement in dredging a straight channel through the bar at the mouth of the Apalachicola River at various times since 1881, and in dredging a channel about 4,000 feet long, 120 feet wide, and 9 feet in depth across Bulkhead Shoal in 1891–'92. With the appropriations available the dredged cut through the bar had never exceeded 90 feet in width and 9½ feet in depth, and had gradually filled up after each dredging, partly by the deposit of silt from the river and partly by the washing in of material from the sides of the cut.

During the fiscal year ending June 30, 1893, $19,877.29 has been expended. Under contract with Mr. Rittenhouse Moore, of Mobile, Ala., approved October 26, 1892, 55,126 cubic yards of material was dredged from the channel through the bar at the mouth of the Apalachicola River between November 16, 1892, and April 10, 1893, at 33 cents per cubic yard. The dredged cut was about 5,600 feet long, from 70 to 120 feet in width, and 8 feet in depth.

It is anticipated that the cut through Bulkhead Shoal will be reasonably permanent. Experience has shown that the bar at the mouth of the Apalachicola River will require redredging at least once in two years unless the cut is made deeper and wider than has been hitherto possible with the funds available. It is possible that a deeper and wider cut may be more permanent.

The commerce of Apalachicola Bay consists mainly in the exportation of lumber, which is transported from the mainland to the anchorage grounds in lighters and rafts, towed by tugs drawing from 5 to 7 feet of water. When the depth in the channel across the bar is reduced below 7 feet much trouble is experienced in carrying on the business of the port.

July 1, 1892, balance unexpended	$48.93
Amount appropriated by act approved July 13, 1892	20,000.00
	20,048.93
June 30, 1893, amount expended during fiscal year	19,877.29
July 1, 1893, balance unexpended	171.64
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	50,000.00

(See Appendix P 1.)

2. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.—The examination and survey of the Apalachicola River, finished in 1873, showed that the river, throughout its length of 105 miles, had a channel not less than 6 feet deep. The channel was, however, much obstructed by the accumulation of logs and snags brought into it by the freshets in the Chattahoochee and Flint rivers and by the trees which had fallen from its own heavily timbered banks. At Moccasin Slough the river had been obstructed by piles driven by Confederate authorities during the war. Drift had accumulated against these piles, forming a dam across the river, which had then forced a narrow and very crooked channel through its banks into the river Styx. Navigation was difficult at the upper and lower elbows on account of the abrupt bends and narrow channel.

The original project for the improvement of the river provided for securing a channel 100 feet wide and 6 feet deep by the removal of snags and overhanging trees and widening and straightening the channel at Moccasin Slough and the Elbows, at an estimated cost of $80,333.

In conformity with the act of September 19, 1890, this project was in that year modified by adding thereto the securing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Lower Chipola River, at an estimated cost of $7,500.

The expenditure between 1874 and June 30, 1892, of $44,565.90 had resulted in clearing out the great accumulation of logs and snags and overhanging trees which originally obstructed the Apalachicola River, and in annually removing the new logs and snags brought in by the winter freshets.

A partial improvement had also been effected at Moccasin Slough and the Elbows, but navigation at these points was still difficult. A large quantity of drift and many overhanging trees were removed from the Cut-off and the Lower Chipola River, and steamboats were enabled to reach the landings above and below Lee Slough. Funds available had not been sufficient to do any work in Lee Slough itself, through which steamboat navigation was completely obstructed by drift, sunken logs, and trees.

During the fiscal year ending June 30, 1893, the sum of $5,000 has been expended in removing snags, sunken logs, and overhanging trees from the Apalachicola River, the Cut-off, and Lower Chipola River, and in opening a practicable but narrow and crooked channel through Lee Slough. Steamboats can now, with some difficulty, pass through the Cut-off, Lee Slough, and Lower Chipola River on the upstream passage. These waterways afforded the only practicable means of transportation for the products of this section of country, which is being rapidly settled by fruit-growers, and it is very desirable that a sufficient appropriation shall be made to enable a safe channel to be opened through Lee Slough.

The Cut-off is a navigable waterway about 3 miles long, connecting the Apalachicola River with the Lower Chipola River near the Dead Lakes. The Chipola River empties into the Apalachicola River about 14 miles below its junction with the Cut-off. "Lee Slough" is simply a local name for a portion of the Lower Chipola River, about 3 miles long (see map at page 1697 of the Annual Report of the Chief of Engineers for 1891). It is therefore suggested that the wording of the next appropriation for this river be changed from "Apalachicola River, including Lee Slough," to "Apalachicola River, including the Cut-off and Lower Chipola River," in order that the work required to be done may be correctly designated.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	11,000.00

(See Appendix P 2.)

3. Flint River, Georgia.—Before the improvement was begun the river was only navigable at low water from its junction with the Chattahoochee River up to Bainbridge, and the channel over this portion was narrow, crooked, and much obstructed by logs, snags, and overhanging trees.

The present project for the improvement of this river was adopted in 1873 and modified in 1879, the object of the original project being to afford a channel 100 feet wide and 3 feet deep at low water from its mouth up to Albany, Ga., an estimated distance of 105 miles, and of the modification to provide a navigable channel for light-draft steamers, at moderate stages of water, from Albany to Montezuma, an estimated distance of 77 miles.

Previous to the act of June 18, 1878, $70,000 was appropriated for the "Chattahoochee and Flint rivers," of which $18,000 was expended on the Flint River.

The expenditure up to June 30, 1892, was $170,301.58.

Above Albany the channel had been partially cleared of logs and snags and overhanging trees and, to a limited extent, of loose rock.

Below Albany the river had been kept in good navigable condition between Bainbridge and the mouth by the annual removal of snags and drift brought in by the winter freshets. Between Albany and Bainbridge a practicable low-water channel had been completed through the rock shoals for a distance of 22 miles below Albany. Between this point and Bainbridge a partial improvement had been effected, which enabled boats to run at moderate stages of water.

During the fiscal year ending June 30, 1893, $10,121.60 was expended in the care and preservation of plant, in the providing of motive power for the snag boat, and in continuing work under the approved project.

Between the mouth of the river and Bainbridge, Ga., an estimated distance of 36 miles, the river is in fairly good condition, and requires little more than the annual clearing out of snags and drift brought in by the winter freshets. On this portion of the river the many steamboats plying on the Chattahoochee and Apalachicola rivers make regular trips and do a large business, and the maintenance of the navigation is, therefore, of great commercial benefit.

Between Bainbridge and Albany, Ga., an estimated distance of 69 miles, the improvement consists mainly in excavating a channel through the many rock shoals and reefs and in depositing the excavated material in spur dams. The improvement, when completed, will be of a permanent character, but for its preservation and for the annual removal of the snags and drift it will be necessary to maintain a snag boat on the river, at an estimated cost of $6,000. A considerable river trade had been developed on this section of the river in consequence of the improvements already effected. The business will probably be much increased as low-water navigation is facilitated by further work.

Above Albany for a distance of 38 miles to Warwick, Ga., low-water navigation is prevented by a series of rock shoals, on which the low-water depth varies from 6 to 18 inches. The loose bowlders have been partially removed from the channel on this portion of the river. Experience in the work shows that a practicable and useful navigation of this portion of the river at moderate stages of water can probably be secured only by providing slack-water navigation, by the construction of locks and dams, at great expense.

Between Warwick and Montezuma, an estimated distance of 39 miles, the improvement consists mainly in the removal of logs and drift and overhanging trees, and has been sufficiently accomplished to permit navigation at moderate stages of water; but no commercial use has been made of this section of the river since July, 1890, when the Montezuma Steamboat Company disposed of their small steamer. It is not believed that any commercial benefit has since been derived from

continuing the improvement of the Flint River above Albany. Two bridges, without draw openings, at distances, respectively, of 16 and 41 miles above Albany, obstruct steamboat navigation, but no measures have been taken to require the owners of the bridges to provide them with draw openings for the reason that no complaints have been made against them.

It is useless to continue the improvement above Albany, for commercial purposes, unless these bridges are provided with draw openings, and it seems to be an unnecessary hardship to compel the owners to provide draw openings to accommodate a commerce which does not now exist and of which there is no immediate prospect. For this reason, and on account of the improbability of being able to secure a satisfactory navigation without the construction of locks and dams, at a cost entirely incommensurate with any prospective commerce to be developed thereby, it is recommended that no further allotments be made, for the present at least, for the improvement of the Flint River above Albany, but that the whole appropriation be expended in continuing the useful and important work below Albany.

July 1, 1892, balance unexpended	$4,728.43
Amount appropriated by act approved July 13, 1892	15,000.00
	19,728.43
June 30, 1893, amount expended during fiscal year	10,121.60
July 1, 1893, balance unexpended	9,606.83
July 1, 1893, outstanding liabilities	1,004.44
July 1, 1893, balance available	8,602.39
Amount that can be profitably expended below Albany in fiscal year ending June 30, 1895. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	38,000.00

(See Appendix P 3.)

4. Chattahoochee River, Georgia and Alabama.—The river was originally much obstructed by logs, snags, and overhanging trees, and by a number of rock and marl shoals and sand bars, so that navigation was difficult and dangerous. Steamboats could only run by daylight, and not unfrequently lay for weeks at a time awaiting a rise in the river. Very many were sunk by striking obstructions.

The present plan of improvement, adopted in 1873 and modified in 1882, contemplates a low-water channel 4 feet in depth and 100 feet in width from Columbus, Ga., to Chattahoochee, Fla., a distance of 224 miles, by the removal of snags and other obstructions from the channel and overhanging trees from the banks, by the excavation of rock shoals, and by works of contraction and shore protection.

Previous to the act of June 18, 1878, $70,000 was appropriated for the "Chattahoochee and Flint rivers," of which $52,000 was expended on the Chattahoochee River.

The expenditure of $243,545.87, up to June 30, 1892, had resulted in securing and maintaining a fairly good channel between Chattahoochee, Fla, and Eufaula, Ala., except at Rock Island, at all seasons of the year; and between Eufaula, Ala., and Columbus, Ga., except during low water, when considerable trouble was experienced at St. Francis Bend, Shell Creek, Upatoie, Woolfolk, and Mound bars, and at the shoals immediately below Columbus, on account of the lack of funds for keeping in repair and extending the contraction and shore protection works at those points.

During the fiscal year ending June 30, 1893, $13,315.94 has been expended in snagging operations, and in the construction of shore protection and contraction works at Mound Bar, by which the low-water navigation at this point has been greatly facilitated. The available funds were not, however, sufficient to make the work of so permanent a character as is desirable.

Several lines of steamboats now make regular trips, with but few detentions, and do a large passenger and freight business, between Columbus, Ga., and Apalachicola, Fla., and Bainbridge, Ga., on the Flint River. A large section of prosperous and well-settled country is entirely dependent upon the river for the transportation of its products and supplies.

The limited annual appropriations for this improvement have not been sufficient to maintain properly the works of contraction originally constructed, nor to extend or modify them as required. At the Mound Bar the caving of the banks has been partly checked, and the channel improved by the work of the past year, but the revetments and spur dams will need strengthening and extension. At Woolfolk Bar the banks are caving badly. At the shoals below Columbus, Ga., which were formerly improved by the construction of a series of spur dams of light construction, the dams have been so damaged and washed away that great difficulty was experienced during the last year in passing over this part of the river. Unless sufficient appropriations are made for the renewal and extension of the works at this point, it is very probable that steamboats cannot be able to reach Columbus, Ga., during the next low-water season.

Trouble is also experienced at low water at Francis Bend, Shell Creek, and Upatoie bars, above Eufaula, and at Rock Island, about 200 miles below Columbus.

If sufficiently large appropriations were made to improve these localities by substantial works, it is believed that thereafter the navigation of the river could be maintained in good condition throughout the year by annual appropriations of $10,000 for the operation of an efficient snag boat, and for the maintenance of the contraction and shore-protection works.

The hull of the snag boat *Chattahoochee* is nearly worn out, and can not be further repaired. The maintenance of an efficient snag boat is absolutely essential to the safe navigation of the river. The present snag boat will have to be practically rebuilt, at an estimated cost of $10,000, before another season.

For the above reasons an estimate of $100,000 is submitted for this improvement for the fiscal year ending June 30, 1895:

July 1, 1892, balance unexpended	$1,472.34
Amount appropriated by act approved July 13, 1892	20,000.00
	21,472.34
June 30, 1893, amount expended during fiscal year	13,315.94
July 1, 1893, balance unexpended	8,156.40
July 1, 1893, outstanding liabilities	2,569.91
July 1, 1893, balance available	5,586.49
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Between West Point and Franklin, Ga.—This section of 38 miles of the river consists of a series of pools, varying in length from one-

half to 5 or 6 miles, and separated by rock shoals and rapids, in some of which the fall is as great as 8 feet to the mile. In the pools the width of the river is from 300 to 500 feet with a channel nowhere less than 4 feet deep. At the shoals the river is much wider, with numerous islands, and low-water depths in many places of only a few inches. The bottom is generally of rock, and the banks are stable. There are few, if any, sand or gravel bars, and but few snags.

The river and harbor act of September 19, 1890, provided for a preliminary examination of the Chattahoochee River between West Point and Franklin. This examination was made in November, 1890, and reports of results are printed at page 1756 of the report of the Chief of Engineers for 1891.

The river and harbor act of July 13, 1892, provided for "improving Chattahoochee River, Georgia and Alabama; continuing improvement, twenty-five thousand dollars, of which five thousand dollars are to be used on that portion of the river between West Point and Franklin."

The project for the improvement of this section of the river, submitted July 26, 1892, and approved August 4, 1892, contemplates removal of the lesser rock shoals, sand and gravel bars, by excavation and by works of contraction; removal of overhanging trees from the banks, and snags, logs, and other obstructions from the channel, and the construction of locks and dams to overcome the more serious obstructions to give a minimum depth of 3 feet at low water in the channel between West Point and Franklin, a distance of 38 miles.

During the fiscal year ending June 30, 1893, $2,759.61 was expended in procuring the necessary plant, in rock excavation at certain of the shoals above West Point, and in depositing the excavated material in training dams, and in making a survey for a short canal and lock around the 6-foot milldam at Bentley Mill.

The available balance will be expended during the low-water season of 1893 in continuing rock excavation at the rapids above West Point. It is probable that the improvement will be carried to the foot of Potts Shoals, about 6 or 7 miles above West Point. A useful navigation through these shoals can only be secured by the construction of locks and dams. By the close of the present working season the improvement will probably have been carried as far as can be usefully done under the approved method, and no estimate is therefore submitted of the amount that can be profitably expended during the fiscal year ending June 30, 1895.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	2,759.61
July 1, 1893, balance unexpended	2,240.39
July 1, 1893, outstanding liabilities	256.89
July 1; 1893, balance available	1,983.50

(See Appendix P 4.)

5. La Grange Bayou and Holmes River, Florida.—La Grange Bayou is situated on the north side and near the head of Choctawhatchee Bay, and into it flows Cedar Creek, a deep stream from 90 to 160 feet wide, on which is situated the town of Freeport, 1½ miles above the bayou.

The channel through the bayou was originally narrow and shoal and obstructed by logs and drift.

An examination of the bayou was made under the act of Congress approved March 3, 1881, and an estimate submitted for dredging the

channel, so as to admit the passage of vessels drawing 4½ feet at mean low water, at a cost of $19,994.30.

In 1883 the sum of $2,000, allotted from the appropriation of $20,000 made by the act of August 2, 1882, for the improvement of Choctawhatchee River, Florida, was expended on La Grange Bayou, mainly in removing snags and drift and in dredging a small amount of mud from the shoalest parts of the channel. Since then no work has been done.

The act of August 5, 1886, appropriated $2,000 for this improvement. So small a sum could not be profitably expended, and it was decided to hold it until an additional appropriation was made for the work.

The act of August 11, 1888, appropriated $3,000 for *completing* the improvement of La Grange Bayou, including Holmes River up to the town of Vernon.

An examination and partial survey made in 1889 showed that the amount of $5,000, then available for the improvement, was not sufficient to *complete* it, as required by the act, and the Secretary of War therefore directed that no further expenditures should be made.

The act of September 19, 1890, appropriated $3,000 for "improving La Grange Bayou, continuing improvement of Holmes River, Florida."

Holmes River is an affluent of the Choctawhatchee River. Its improvement has no connection whatever with that of La Grange Bayou. It is a deep stream, but was much obstructed by snags, logs, and overhanging trees.

During the fiscal year ending June 30, 1891, the sum of $3,000 was expended in removing these obstructions. For this purpose the log boat belonging to the Choctawhatchee River was used.

The river was then in good navigable condition, but very little business is done on it. The improvement made will probably render the navigation of the river safe for some time, and therefore no further appropriation is now recommended.

July 1, 1892, balance unexpended	$4,839.20
July 1, 1893, balance unexpended	4,839.20

(See Appendix P 5.)

6. Choctawhatchee River, Florida and Alabama.—When work on the improvement was begun, in 1874, the river, notwithstanding an average width of 300 feet, was almost totally obstructed by the accumulation of logs and snags, and navigation was only possible by flatboats of light draft. The channel, if a channel existed at all, was exceedingly dangerous to navigation, particularly during the lower stages of water.

The project for improvement adopted in 1880 provided for obtaining a low-water navigable channel from its mouth to Geneva, Ala., an estimated distance of 125 miles, and a navigable high-water channel from Geneva to Newton, Ala., an estimated distance of 37 miles.

In 1890 the project was amended to provide for securing a low-water channel from Geneva to Newton.

The improvement consists in the removal of logs and snags from the channel and overhanging trees from the banks, in deepening sand bars by works of contraction and shore protection, and in excavating a channel through the rock and marl shoals.

The expenditure up to June 30, 1892, of $104,178.28 had resulted in sufficiently removing the obstructions from the river between its mouth and Caryville to meet the requirements of the present commerce on that section of the river and in giving a fairly navigable channel, except at extreme low water, from the crossing of the Pensacola and

Atlantic Railroad, at Caryville, Fla., to Geneva, Ala., a distance of 25 miles, and a partially improved channel from Geneva to Pate Landing, 25 miles above.

Steamboats now run with considerable regularity from Geneva, Ala., to the railroad at Caryville.

During the year ending June 30, 1893, $7,582.66 was expended in snagging operations between Geneva and Caryville, in providing plant for carrying on the works of contraction and shore protection at the troublesome bars, and in work of this character at Buzzard Bar, Gumfield Shoals, and Busby Shoals.

Geneva is a thriving town, the trading and shipping center for a rich agricultural region surrounding it. The river affords the only practicable means of transportation to this district. During recent years the work has, therefore, mainly been directed to improving this section of the river, and has resulted in clearing out a large number of the accumulated logs and snags. Low-water navigation is impeded by several sand bars, which can be readily deepened by works of contraction and shore protection if sufficient funds are appropriated for the purpose.

When freight offers steamboats occasionally run to Pate Landing at favorable stages of water.

Since the completion of the Alabama Midland Railroad from Montgomery, Ala., to Bainbridge, Ga., which passes through Newton, the urgent necessity for improving the upper portion of the river no longer exists, and it is doubtful if this section of the river would now be much used, even if the improvements were completed.

The plan, therefore, contemplates completing the improvement between Geneva and Caryville, and then between Geneva and Pate Landing, before beginning any work upon the marl shoals which now obstruct navigation between Newton and Pate Landing. It is very doubtful whether a safe low-water navigation of this section of the river can be secured except by the construction of locks and dams, to provide slack-water navigation, at a cost not warranted by any prospective commerce to be developed thereby.

July 1, 1892, balance unexpended	$5,321.72
Amount appropriated by act approved July 13, 1892	12,500.00
	17,821.72
June 30, 1893, amount expended during fiscal year	7,582.66
July 1, 1893, balance unexpended	10,239.06
July 1, 1893, outstanding liabilities	573.75
July 1, 1893, balance available	9,665.31
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	30,000.00

(See Appendix P 6.)

7. Harbor at Pensacola, Fla.—In 1878 the channel was much obstructed by wrecks, and a survey made in 1879 showed that the inner bar had shoaled to a least depth of 19.5 feet at mean low water. This depth was not sufficient to accommodate a large number of vessels seeking entrance to the port. The western shore of the entrance to the harbor, which is the site of old Fort McRee, was fast washing away, and a large portion of the fort had disappeared. Corresponding changes in the direction of the channel and of the tidal currents had occurred, and to this was partly attributed the shoaling of the inner bar. The removal of the wrecks was begun in 1878.

The plan of improvement adopted in 1881, in accordance with the report of the Board of Engineers, contemplated dredging a channel 300 feet wide and 24 feet deep at mean low water across the inner bar, for the temporary relief of the navigation of the harbor and protecting the shore line near Fort McRee from further abrasion, with the view of preventing injurious changes in the tidal currents, and retaining this position for defensive purposes.

The expenditure up to June 30, 1892, of $260,810.56 had resulted in obtaining, temporarily, a channel across the inner bar reported to be 120 feet wide and 24 feet deep, at mean low water, at the conclusion of dredging operations in 1886.

This channel had shoaled to a least depth of 19 feet in June, 1891, and was then redredged to a least depth of 20.5 feet. In November, 1892, the channel had again shoaled to a least depth of 19.2 feet. The further abrasion of the western shore line near Fort McRee was stopped by the construction of two groins north of the fort and nearly at right angles to the shore, having lengths of 360 and 220 feet, respectively. The groins were built of stone and concrete and were completed in April, 1890.

During the year ending June 30, 1893, $5,895.59 was expended in the care and preservation of the property belonging to the improvement and in dredging on the inner bar in accordance with the requirements of the appropriation act of July 13, 1892. This dredging is now being done with a suction dredge under contract with Mr. Rittenhouse Moore, of Mobile, Ala., executed October 29, 1892, and approved November 11, 1892, at 63 cents per cubic yard. The contract required the work to begin not later than January 1, 1893, and to be completed by January 1, 1894. The time for beginning work was extended to May 11, 1893. The dredge reported at Pensacola Harbor on May 13, 1893, but did not actually do any dredging until the 24th. The dredging is now being carried on continuously night and day and without accident. It is expected that the available funds will be exhausted by September 15, and that a channel 24 feet in depth and from 200 to 225 feet in width will have been secured across the inner bar; but for the reasons given in the report of the officer in charge it seems probable that this channel may soon fill up, by reason of the steady growth of the middle ground to the southward.

On January 17, 1891, a Board of Engineers was appointed to assemble at Pensacola, Fla., for the purpose of considering and reporting upon the improvement of the harbor. The report of the board, dated July 16, 1891, is printed in the Annual Report of the Chief of Engineers for 1891, page 1723, and extracts thereform, describing the proposed method of securing a permament deep channel at the entrance to Pensacola Harbor by means of two jetties, starting from the shores near forts Pickens and McRee, respectively, at an estimated cost of $1,830,000, are given in the report of the officer in charge.

July 1, 1892, balance unexpended		$14,189.44
Amount appropriated by act approved July 13, 1892		75,000.00
		89,189.44
June 30, 1893, amount expended during fiscal year		5,895.59
July 1, 1893, balance unexpended		83,293.85
July 1, 1893, outstanding liabilities	$515.54	
July 1, 1893, amount covered by uncompleted contracts	74,811.81	
		75,327.35
July 1, 1893, balance available		7,966.50

{ Amount that can be profitably expended in fiscal year ending June 30, 1895 $500,000.00
{ Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix P 7.)

8. Escambia and Conecuh rivers, Florida and Alabama.—These rivers are really one river, that portion of the river from its headwaters in south Alabama to the Florida and Alabama State line being called the Conecuh River, and the portion in Florida, 61 miles long, being called the Escambia River. It empties into the Escambia Bay, an indentation from Pensacola Bay. Fully 60 per cent of the immense quantity of timber shipped from Pensacola Harbor is cut on lands tributary to the Escambia River and floated down in rafts to Pensacola Harbor.

The river originally was much obstructed by snags, sunken logs, and rock shoals, and by a very shoal bar at the mouth. Steamboat navigation was not attempted, and rafts had great difficulty in passing down the river.

The plan of improvement for this river, adopted pursuant to examinations and surveys made in 1878, contemplates the removal of snags, sunken logs, and other obstructions from the channel; cutting through the rock shoals, and deepening sand bars, by works of contraction and shore protection, from the mouth of the river, in Pensacola Bay, to the mouth of Indian Creek, an estimated distance of 293 miles, for the purpose of facilitating the movement of timber down the river, affording at the same time facilities for steamboat navigation.

The amount expended up to June 30, 1892, $63,996.63 had resulted in providing, maintaining, and renewing the necessary plant; in twice dredging the channel through the bar at the mouth of the river to permit the passage of tugboats drawing 5 feet of water; in the removal of a large number of the accumulated logs and snags from its mouth to Jordan Shoals, a distance of 136 miles, and in keeping the improved channel fairly free from logs and snags brought in by the winter freshets. There was then a fairly navigable channel from the mouth of the river to Jordan Shoals, a distance of 136 miles, for stages of water 2½ feet above low water.

During the fiscal year ending June 30, 1893, $7,982.17 was expended in providing the snagboat with its own motive power by the addition of a stern-wheel, with a boiler and engines for running it, and in snagging operations at various points along the river where the greatest trouble was experienced in navigation.

This river and its tributaries pass through the extensive timber lands of south Alabama and Florida, and the value of the lumber annually taken to market by the river is estimated at over $1,800,000.

In order that the business may be carried on safely and profitably the river should be kept free from snags and like obstructions by an efficient snagboat; and a channel 100 feet wide and 8½ feet deep should be dredged through the bar at the mouth of the river, in order that the large tugs employed in towing the rafts to Pensacola may cross the bar and enter the river for the purpose of reaching the rafts. The rafts are now floated across the bar and fastened to timber stands in the open bay, where they are exposed to sudden storms, and a large annual loss in money and lumber is thus occasioned.

The cost of dredging the bar at the mouth of the river is estimated at $12,000. The annual cost of operating the snagboat is estimated at $6,000, or $12,000 for two years.

July 1, 1892, balance unexpended	$2,671.08
Amount appropriated by act approved July 13, 1892	8,000.00
	10,671.08
June 30, 1893, amount expended during fiscal year	7,982.17
July 1, 1893, balance unexpended	2,688.91
July 1, 1893, outstanding liabilities	568.30
July 1, 1893, balance available	2,120.61
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	24,000.00

(See Appendix P 8.)

9. Alabama River, Alabama.—Before improvements were begun, in 1878, the river was so full of sunken logs and snags that many steamboats were destroyed and navigation was both difficult and dangerous, on account of the many bars, shoals, and reefs, having low-water depths of only 2½ to 3½ feet. That portion of the river below the cut-off, 20 miles in length, was absolutely inaccessible during low water, and all landings situated thereupon had been deprived of steamboat service. At low-water stages boats could only run by daylight, and long detentions at the shoals and bars were frequent. The normal width of the upper river is from 500 to 600 feet, and of the lower river from 700 to 800 feet. In the portions of the river having these widths the low-water depths vary from 8 to 15 feet, but where the river has been widened by the erosion of its banks, bars, shoals, and reefs are found.

The original plan of improvement, adopted pursuant to an examination and partial survey of this river made under the act of Congress approved March 3, 1875, provided for obtaining a 4-foot low-water channel from the mouth of the river to Wetumpka, Ala. In 1892, the present plan of improvements was adopted, which provides for obtaining a low-water channel 6 feet deep from Wetumpka, Ala., to the junction with the Tombigbee River, 44 miles above Mobile, Ala., an estimated distance of 323 miles, by the removal of logs and snags from the channel and overhanging trees from the banks; by the removal of rock reefs and gravel bars by blasting and dredging; and deepening sand bars by works of contraction and shore protection, at an estimated cost (prior to the appropriation of July 13, 1892, of $70,000), of $386,251, exclusive of the cost of maintenance and snagging, estimated at $10,000 per annum.

The expenditure of $177,985.78 up to June 30, 1892, had resulted in clearing the river of dangerous snags and logs and overhanging trees; in maintaining an efficient stern-wheel snag boat for the removal of the logs and snags brought in by the winter freshets; in the improvement of eight of the worst bars by works of contraction, which, however, had not been maintained on account of inadequate appropriations and then needed extensive repairs; in opening the 20 miles of river below the cut-off; in an increased safety to navigation; greater regularity, and reduction in time, of trips; and in enabling boats to carry greater loads. Boats now run by night as well as by day, at all stages of water.

During the year ending June 30, 1893, $38,272.39 was expended in snagging operations; in procuring plant for contraction and shore protection works; in building training dams, and in protecting the shores at Three Chutes Bar, Hadnot Bar, Manack Island, and at Silver Creek Shoals. The effect of the training dams built has been very satisfac-

tory, and has resulted in deepening the channels at those bars, which were serious impediments to low-water navigation.

When the appropriation of $70,000 by act of July 13, 1892, became available, the only plant on this river consisted of the efficient stern-wheel snag boat *Wm. J. Twining*. A plant for two large working parties, one on the upper and one on the lower river, has now been procured, each plant consisting of one stern-wheel towboat, one quarters boat, one pile-driver barge, one small-decked flatboat for carrying piles, two stone barges, and one brush barge. With this plant, the balance now available will be expended in vigorously carrying on the work during the low-water season of 1893. The contraction works, built in 1878 and 1883, and in 1892, have given so satisfactory results that no especial difficulty is anticipated in securing low-water depths of 6 feet on the bars now having less depths, provided sufficiently large appropriations are made to carry on the work with an efficient plant and a large working force during the low-water season.

July 1, 1892, balance unexpended	$7,014.22
Amount appropriated by act approved July 13, 1892	70,000.00
	77,014.22
June 30, 1893, amount expended during fiscal year	38,272.39
July 1, 1893, balance unexpended	38,741.83
July 1, 1893, outstanding liabilities	8,111.91
July 1, 1893, balance available	30,629.92

Amount (estimated) required for completion of existing project (excluding cost of annual maintenance and snagging at $10,000 per year)	336,251.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix, P 9.)*

10. Tallapoosa River, Alabama.—When first examined, in 1881, low-water navigation was entirely impracticable, and high-water navigation was difficult and dangerous, on account of the great accumulation of logs and snags in the channel, and of the numerous sand and gravel bars and a few rock reefs. Where not obstructed the river presented, generally, long reaches of fine navigable water, with a width of 200 to 300 feet, and a depth of 6 to 12 feet, but where the normal width was exceeded, to any extent, sand bars and gravel or rock reefs were found, with a low-water depth of only 1 to 2 feet.

The project for the improvement of the river, adopted in 1881, provided for obtaining a navigable channel from the junction with the Coosa River (where the two rivers form the Alabama River), to the foot of Tallassee Reefs, 2 miles below the town of Tallassee, a distance of 48 miles, with a least depth of 3 feet, and width of 200 feet in open river, and 60 feet through rock reefs, by the removal of snags and logs from the channel and overhanging trees from the banks; by cutting through the rock and gravel reefs; and by deepening sand bars by works of contraction and shore protection.

The expenditure of $43,122.97 had resulted in building, equipping, and keeping in repair a small snag boat (without motive power); in removing to a great extent the large accumulation of snags and logs from the channel, and in cutting down dangerous overhanging timber between the mouth and Cowle Ferry, an estimated distance of 44 miles; and in annually removing the fresh obstructions brought in by the winter freshets, so far as the available funds permitted.

It is not known that any commercial use was made of the improved channel.

From past experience it is not believed that any commercial benefit will be derived from continuing the improvement of the Tallapoosa River at present, and no estimate is submitted for the work.

July 1, 1892, balance unexpended	$947.18
June 30, 1893, amount expended during fiscal year	919.10
July 1, 1893, balance unexpended	28.08
July 1, 1893, outstanding liabilities	9.32
July 1, 1893, balance available	18.76

(See Appendix P 10.)

11. Coosa River, Georgia and Alabama.—With headwaters in the mountains of northwestern Georgia, the Coosawattee, Oostenaula, Coosa, Alabama, and Mobile rivers form, in fact, one great river, which, when the improvement of the Coosa River is completed, will furnish a continuous route of water transportation, 776 miles in length, through the mineral fields of north Alabama, the agricultural belt of middle Alabama, and the timber region of south Alabama, to tide water at Mobile Bay.

A distance of 293 miles of this waterway, above Lock No. 4 (3 miles above the Georgia Pacific Railroad Bridge), and a distance of 367 miles between Wetumpka and Mobile, are now navigable.

Between Lock No. 4 and Wetumpka, a distance of 116 miles, the Coosa River has a fall at low water of 323 feet, and is obstructed by a series of rock shoals and reefs, separated by stretches of good navigable water, varying in length from one-half to 8 miles. The low-water discharge of the Coosa River at Wetumpka is 5,800 cubic feet per second, about the same as that reported for the Mississippi River at St. Paul.

The abundance of water, the stability of the banks and bottom of the river, and the rock foundations for locks and dams, presented in nearly all cases, make the lower portion of the river peculiarly susceptible to permanent improvement by a system of slack-water navigation.

Pursuant to the various examinations and surveys made between 1870 and 1889 a plan of improvement has been adopted, which contemplates the removal of the lesser rock shoals, sand and gravel bars, by excavation and by works of contraction, and the construction of locks and dams to overcome the more serious obstructions.

By the various acts making appropriations for its improvement, the Coosa River has been divided into two sections by the East Tennessee, Virginia and Georgia Railroad Bridge.

In the upper section, between Rome and the bridge (236 miles long), eight locks, with their accessory dams, will be required, of which three have been completed and opened to navigation and the fourth is now under construction.

In the lower section, between Wetumpka and the bridge (68 miles long), twenty-three locks, with their accessory dams, will be required, of which Lock No. 31, at Wetumpka, is now under construction. The first appropriation for this section of the river was made by the act of September 19, 1890.

a. Between Rome, Ga., and the East Tennessee, Virginia and Georgia Railroad Bridge.—Before improvement the river was much obstructed by rock shoals and sand and gravel bars, between Rome, Ga., and Greensport, Ala., a distance of 162 miles; and below Greensport it was not navigable at all, on account of the many shoals and rapids formed

by ledges of rock crossing the river bottom at points where the width of the river was greater than the normal.

The expenditure up to June 30, 1892, of $667,844.23 had resulted in securing a fairly navigable channel from Rome to Greensport by blasting out the rock shoals and by the construction of wing dams to scour out the sand bars.

Below Greensport, at distances, respectively, of 0.68, 3.86, and 5.24 miles, three masonary locks, each having an available width of 40 feet and length of 175 feet, with their accessory dams, had been completed and opened to navigation. In consequence of the improvement steamboats made regular trips between Rome and Gadsden, and, when business demanded it, extended their trips to a landing 1 mile below Lock No. 3.

At the site of Lock No. 4, 21 miles below Lock No. 3, the permanent dam and abutment had been nearly completed and the cofferdam partly built, making navigation practicable on a moderate rise to this point.

During the year ending June 30, 1893, the sum of $85,563.21 has been expended in channel work on the shoals and reefs between locks Nos. 3 and 4; on the cofferdam for the lock, and in stopping leaks through the rock foundation in the same; in quarrying and cutting stone for Lock No. 4, and transporting it from the quarry to the site of the lock; in the coping of the west abutment of the dam, and in shore protection below it; in completing and repairing Dam No. 4; and in the purchase of plant, including the stern-wheel towboat.

In the improved portions, during about nine months of the year, there is 5 feet or more of water in the shoal places, and for the remaining three months there is ordinarily 3 feet. The river is never closed by ice.

The balance now available will be expended by June 30, 1894, in continuing the channel improvement between locks Nos. 3 and 4 and in building Lock No. 4, but it will not be sufficient to complete this lock.

If the new appropriation be sufficiently large it is expected that Lock No. 4 will be completed and opened to navigation, and work will be begun on one or more of the locks to be built below it during the year ending June 30, 1895.

July 1, 1892, balance unexpended	$5,855.77
Amount appropriated by act approved July 13, 1892	130,000.00
	135,855.77
June 30, 1893, amount expended during fiscal year	85,563.21
July 1, 1893, balance unexpended	50,292.56
July 1, 1893, outstanding liabilities	8,844.08
July 1, 1893, balance available	41,448.48
Amount (estimated) required for completion of existing project	960,133.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	600,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

b. Between Wetumpka, Ala., and East Tennessee, Virginia and Georgia Railroad Bridge.—The first appropriation for the improvement of this section of the river was made by the act of September 19, 1890.

To June 30, 1892, the sum of $45,263.94 was expended in procuring the necessary outfit and in making detailed surveys for the precise location of the locks near Wetumpka and in making a series of velocity and discharge observations, extending from high to low water; in fill-

ing up and grading the yard at the site of Lock No. 31 and building thereon workshops, etc.; in the purchase of machinery and plant for the construction of the cofferdam and Lock No. 31; in excavating rock from the channel of the river above Wetumpka Bridge, and in building a breakwater to divert the current from the lock site.

During the year ending June 30, 1893, the sum of $62,937.51 has been expended.

The land at the site of Lock No 31 has been procured by condemnation proceedings; the lock-keeper's house, to be used during the construction as an office and quarters, has been built; the rock excavation from the channel above the Wetumpka Bridge has been continued, the soft rock has been deposited as a protection to the caving bank, and the hard rock has been broken up for use in making concrete; a dredge and machinery for pumping sand from the river bed have been procured, and a large quantity of sand has been pumped up and stored for use in making concrete; 380 linear feet of cofferdam has been built. The construction of the cofferdam has been attended with unusual difficulty on account of the depth of water in which it is necessary to build it and on account of the succession of floods, caused by the excessive rainfall extending throughout the year.

Lock No. 31 is to be built of concrete. A very complete plant for carrying on the work has now been obtained, and it is expected that the lock can be rapidly pushed to completion after the cofferdam is finished and that the available funds will be exhausted by June 30, 1894.

Should the new appropriation be sufficiently large, it is intended to begin with it the construction of locks Nos. 30 and 29, and to use in that work the plant which has been bought for building Lock No. 31.

July 1, 1892, balance unexpended		$104,736.06
Amount appropriated by act approved July 13, 1892		100,000.00
		204,736.06
June 30, 1893, amount expended during fiscal year		62,937.51
July 1, 1893, balance unexpended		141,798.55
July 1, 1893, outstanding liabilities	$5,053.70	
July 1, 1893, amount covered by uncompleted contracts	3,073.50	
		8,127.20
July 1, 1893, balance available		133,671.35
Amount (estimated) required for completion of existing project		4,843,074.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		600,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix P 11.)

12. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—The expenses of operating and care of locks Nos. 1, 2, and 3 and the canal between locks Nos. 2 and 3 during the fiscal year ending June 30, 1893, amounting to $9,366.56, have been paid in the manner indicated by section 4, act of July 5, 1884. (See Appendix P 12.)

13. Cahaba River, Alabama.—The report of the examination of this river from its mouth to Centerville, Ala., in 1874, states that—

> On thirteen of the shoals there is only 1 foot of water, and on two as little as eight-tenths of a foot. Besides this there are innumerable snags, the accumulation of years, and also a great quantity of leaning trees, which must be removed owing to the narrowness of the stream even at a stage several feet above low water. * * * The river is spanned by three bridges. * * * The railroad bridges are only a few inches above high water, while the road bridge is sometimes submerged.

The road bridge mentioned was carried away by the flood of 1881.

Under the acts of Congress approved June 23, 1874, and June 17, 1880, examinations and partial surveys were made in 1874 and in 1880, and a plan of improvement was adopted which provides for obtaining for the lower Cahaba River, from its mouth to the town of Centerville, a distance of 88 miles, a navigable channel with a width in open river of 100 feet, and in soft rock and bar cuts of 60 feet, and a depth at low water of 3 feet, by the removal of snags, etc., from the channel and overhanging trees from the banks, by cutting through the soft rock and gravel bars, and by contracting and regulating the channel.

The expenditure up to June 30, 1886, of $28,989.79 had resulted in the partial improvement of the river from its mouth to the town of Centerville, for high-water navigation; but, on account of the obstructing railroad bridges, steamboats were unable to make any use of the improved river. Since that time no work has been done, because of a proviso in the river and harbor act of August 5, 1886, that—

No part of said sum [$7,500 appropriated for this work] shall be expended until the officer in charge shall have reported that the railroad and other bridges across said river have been provided with good and sufficient draw openings.

These bridges continue to obstruct the navigation of the river, not having been provided with draw openings.

The act of September 19, 1890, provided that—

The existing provision restricting the expenditure of the balance now available for continuing the improvement of said river is hereby repealed, and said balance shall be expended in continuing the improvement thereof.

Between June 30, 1886, and June 30, 1892, the sum of $8,430.44 was expended. In the spring of 1891 active operations on the river were resumed. A log boat suitable for snagging operations was built, and employed during the following summer in work below Wallace Ferry.

During the fiscal year ending June 30, 1893, $3,610.31 was expended in working on the lower 21⅓ miles of the river. At the close of operations in December, 1892, the channel for this distance was free from overhanging timber, logs, and snags, but no commercial use was made of the improvement.

On March 31, 1892, the officer in charge, in conformity with section 11 of the act of September 19, 1890, reported that the navigation of the Cahaba River was obstructed by the bridge of the Birmingham, Selma and New Orleans Railroad, about 10 miles above the mouth of the river, and by the bridge of the Alabama Central Division of the East Tennessee, Virginia and Georgia Railroad, about 22 miles above its mouth. Neither of these bridges has been provided with draw spans.

The officer in charge was directed to grant a hearing to each of the railroad companies, in accordance with the instructions of the War Department of September 16, 1891.

No commercial benefit commensurate with the cost of the work can be derived from continuing the improvement of the river, unless the obstructing bridges are provided with draw spans, to permit of steamboat navigation. There is no apparent desire on the part of those interested that the railroads shall be compelled to provide the bridges with draws. At the hearing mentioned above many affidavits by residents along the river were submitted, protesting against compelling the railroads to provide the bridges with draws, and not a word was received in favor of such action.

In view of these facts it is not considered that any money can be profitably expended in the improvement of the river during the fiscal year ending June 30, 1895, and no estimate is submitted therefor.

July 1, 1892, balance unexpended	$79.77
Amount appropriated by act approved July 13, 1892	7,500.00
	7,579.77
June 30, 1893, amount expended during fiscal year	3,610.31
July 1, 1893, balance unexpended	3,969.46
July 1, 1893, outstanding liabilities	153.28
July 1, 1893, balance available	3,816.18

(See Appendix P 13.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. Philip M. Price, Corps of Engineers, and reports thereon submitted through the Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Bar at the mouth of Alaqua Bayou, Florida, at its entrance into Choctawhatchee Bay.—Capt. Price submitted report of examination under date of September 16, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at this time worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 86, Fifty-second Congress, second session. (See also Appendix P 14.)

2. Bar at the junction of Choctawhatchee Bay and Santa Rosa Sound, Florida.—Capt. Price submitted report of examination under date of April 21, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government. No further survey is necessary for preparation of project and estimate of cost of improvement. (See Appendix P 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI, AND OF BOGUE CHITTO, LOUISIANA.

This district was in the charge of Maj. A. N. Damrell, Corps of Engineers, with Lieut. Eben E. Winslow, Corps of Engineers, under his immediate orders; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Mobile Harbor, Alabama.—The channel had originally a minimum depth of 5½ feet through Choctaw Pass and 8 feet on Dog River Bar. This was deepened to 10 feet through both by dredging, under appropriations from 1826 to 1852 of $228,830.68. In 1860 the channel in Choctaw Pass had shoaled to 7½ feet. From 1870 to 1873 the channel was deepened by dredging to 13 feet, under appropriations amounting to $401,000. Length of cut, 8 miles.

From 1881 to 1888 the channel was deepened by dredging to 17 feet, under appropriations amounting to $740,000, but this project was not completed when the last project was adopted. The length of cut was 25.91 miles.

The present project for the improvement of this harbor was adopted in August, 1888, the object being to afford a channel of entrance from the Gulf of Mexico to the city of Mobile of 280 feet width on top of cut with a central depth of 23 feet at mean low water, by dredging, at an estimated cost of $1,980,000. Act of September 19, 1890, extended the work up Mobile River to the mouth of Chickasabogue Creek, and

increased the estimated cost to $2,043,800. The entire length of channel under present project is 33.09 miles, and the entire length of continuous cut is 32.27 miles. The amount expended on the present project up to the close of the fiscal year ending June 30, 1892, was $581,878.55.

The average central depth of the dredged channel on June 30, 1892, was 24 feet, and the minimum depth on that date was 20.2 feet. The amount expended during the fiscal year ending June 30, 1893, was $178,319.38, and on that date the average central depth of the entire channel was 23.89 feet by the new gauge and 25.59 feet by the old gauge, and the minimum central depth was 19.6 feet by the new gauge and 21.3 feet by the old gauge, with an increased or bottom width wherever excavated of from 20 to 80 feet.

The river and harbor act approved July 13, 1892, authorized contracts to be entered into for completion of the present project of improvement for this work, to be paid for as appropriations may from time to time be made by law.

July 1, 1892, balance unexpended		$18,121.45
Amount appropriated by act approved July 13, 1892		212,500.00
Amount appropriated by sundry civil act approved March 3, 1893		500,000.00
		730,621.45
June 30, 1893, amount expended during fiscal year		178,319.38
July 1, 1893, balance unexpended		552,302.07
July 1, 1893, outstanding liabilities	$42,414.02	
July 1, 1893, amount covered by uncompleted contracts	456,000.00	
		498,414.02
July 1, 1893, balance available		53,888.05
Amount (estimated) required for completion of existing project		681,300.00
Amount required for preservation of improvement		180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		681,300.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix Q 1.)

2. Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek.—The present channel is only navigable during very high water, and is even then extremely dangerous.

The present project for the improvement of this section of the river was adopted in 1886, the object being to afford a waterway for the transportation of coal, iron ore, iron, etc., in barges from the Warrior coal fields to the Gulf of Mexico, by the construction of five locks and dams, at an estimated cost of $741,670.

The amount expended to June 30, 1892, was $324,454.92, resulting as follows:

Lock No. 1: Complete as to masonry, with south bank sloped, paved, and turfed. Lock-tender's house built; dam filled to 9 feet below crest.

Lock No. 2: North wall of lock built and one-third of bank wall.

Lock No. 3: Cofferdam built and 356 yards of ashlar quarried.

The amount expended during the fiscal year ending June 30, 1893, is $79,979.97, and the condition of the work June 30, 1893, was as follows:

Lock No. 1: Masonry of lock and abutment completed; lock-tender's house built; lock yard paved and both banks sloped and paved, nearly; timber and stone filling for dam on hand; needle dam ready to put in.

Lock No. 2: Lock masonry completed; south bank sloped, paved, and turfed; rock filling for dam on hand, 378 yards; grading done for abut-

ment, 3,091 yards; lumber for needle dam on hand and partly framed; face stone and coping for abutment in readiness.

Lock No. 3: Lock chamber excavated; masonry commenced; 2,579 yards of cut stone on hand; 1,750 yards of backing on hand; 932 yards earth excavated for bank wall; 2,321 yards sand for mortar hauled.

July 1, 1892, balance unexpended	$31,795.08
Amount appropriated by act approved July 13, 1892	200,000.00
	231,795.08
June 30, 1893, amount expended during fiscal year	79,979.79
July 1, 1893, balance unexpended	151,815.11
July 1, 1893, outstanding liabilities	5,190.56
July 1, 1893, balance available	146,624.55
Amount (estimated) required for completion of existing project	185,420.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	185,420.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 2.)

3. Warrior and Tombigbee rivers, Alabama and Mississippi.—(a) Warrior River, Alabama.—The channel of this river was originally obstructed to such an extent by logs, snags, overhanging trees, and numerous bars that navigation at low water was impossible and at high water extremely hazardous.

The present project for the improvement of this river was adopted in 1890, the object being to obtain a channel 6 feet deep at ordinary low water from Tuscaloosa to its mouth by removal of logs, snags, and overhanging trees, the improvement of bars, bank revetments, and the construction of locks and dams at an estimated cost of $557,000.

The amount expended up to the close of the fiscal year ending June 30, 1892, was $48,671.86 in preparation of plant and the removal of snags, logs, and overhanging trees, no increased depth being obtained, but the time required to run the river and the hazard attending have both been reduced.

The amount expended during the fiscal year ending June 30, 1893, was $16,294.82 in the removal of snags, logs, slip-ins, and overhanging trees, and resulted in considerably reducing the time required to run the river and the hazard attending at.

July 1, 1892, balance unexpended	$10,296.12
Amount appropriated by act approved July 13, 1892	75,000.00
	85,296.12
June 30, 1893, amount expended during fiscal year	16,294.82
July 1, 1893, balance unexpended	69,001.30
Amount (estimated) required for completion of existing project	457,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

b. Tombigbee River up to Demopolis, Ala.—At the present time the channel has a minimum depth of 2 feet. The present project for the improvement of this section of the river was adopted in 1890, the object being to secure a channel of 6 feet depth at low water, by removal of logs, snags, and bank revetment, and construction of locks and dams at an estimated cost of $508,808. The entire length of this section is 191 miles. The amount expended prior to June 30, 1892, was $48,187.85,

and resulted in the removal of logs, snags, trees, etc., from the river for 140 miles, in the repair of jetties at Osage and Barneys shoals, and the partial removal by blasting of rock shoals at Woods Bluff and McGrews and Pearsons shoals.

The amount expended during the fiscal year ending June 30, 1893, was $20,595.29, and resulted in the removal of logs, snags, trees, etc., from the portion of the river not worked over in the preceding two years and the working over again of 37 miles.

Work of other character was almost completely prevented by the long continuance of high water.

July 1, 1892, balance unexpended	$6,812.15
Amount appropriated by act approved July 13, 1892	125,000.00
	131,812.15
June 30, 1893, amount expended during fiscal year	20,595.29
July 1, 1893, balance unexpended	111,216.86
Amount (estimated) required for completion of existing project	328,808.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	328,808.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

c. Tombigbee River from Demopolis, Ala., to Columbus, Miss.—The present channel has a minimum depth of 1 foot.

The present project for the improvement of this section of the river was adopted in 1890, the object being to obtain a channel of 6 feet depth at an ordinary low water by removal of logs, snags, etc., bank revetment, and construction of locks and dams, at an estimated cost of $779,400. The amount expended prior to June 30, 1892, was $15,000 and resulted in the preparation of a working plant and the clearing of 22½ miles below Windham of snags, logs, trees, etc., and a similar improvement at Ten Mile Shoals.

The amount expended during the fiscal year ending June 30, 1893, was $10,575.28 and resulted in clearing 125 miles of the river, from Pickensville to Demopolis, of snags, logs, trees, etc.

Amount appropriated by act approved July 13, 1892	$35,000.00
June 30, 1893, amount expended during fiscal year	10,575.28
July 1, 1893, balance unexpended	24,424.72
Amount (estimated) required for completion of existing project	729,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

d. Tombigbee River from Fulton to Columbus, Miss.—The channel before improvement was not navigable at all, except during high water, and navigation was practicably suspended when the river reached 12 feet above low water.

The project for the improvement of this section of the river, from Fulton to Columbus, 144 miles, was adopted in 1873, the object being to give a good high-water channel for navigation throughout by the removal of snags, logs, and overhanging trees and was completed.

The amount of $3,193.47 has been expended during the fiscal year ending June 30, 1893, in the removal of snags, logs, and overhanging trees, in preservation of the improvement.

Amount appropriated by act approved July 13, 1892	$6,000.00
June 30, 1893, amount expended during fiscal year	3,193.47
July 1, 1893, balance unexpended	2,806.53

Amount (estimated) required for preservation of improvement	$10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

e. Tombigbee River from Walkers Bridge to Fulton, Miss.—The channel was originally only navigable for small rafts during high water and very troublesome for them.

The present project for the improvement of this section of the river was adopted in 1888, the object being to obtain a good channel for navigation during high water by the removal of snags, logs, stumps, and cutting overhanging trees, at an estimated cost of $11,000.

The amount expended up to the close of the fiscal year ending June 30, 1892, was $7,591.11 and resulted in completion of the project.

The amount expended during the fiscal year ending June 30, 1893, was $2,279.48 and resulted in the removal of the annual accumulation of snags, logs and trees, in preservation of the improvement.

July 1, 1892, balance unexpended	$408.89
Amount appropriated by act approved July 13, 1892	3,000.00
	3,408.89
June 30, 1893, amount expended during fiscal year	2,279.48
July 1, 1893, balance unexpended	1,129.41

Amount (estimated) required for preservation of improvement	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 3.)

4. Noxubee River, Mississippi.—The original condition of the river was such that during all seasons of the year and at all stages of water navigation, except by small flatboats, was practically impossible. The present project for the improvement of this river was adopted in 1880, the object being to afford a channel for small river steamers from its mouth up to Macon, Miss., of navigable width and depth when the water is above ordinary low-water stage.

The amount expended up to the close of the fiscal year ending June 30, 1892, was $49,899.29, and resulted in completion of the project. The amount expended during the fiscal year ending June 30, 1893, $3,067.12, was for repair and alteration of steamer and care and preservation of public property.

July 1, 1892, balance unexpended	$3,100.71
Amount appropriated by act approved July 13, 1892	3,000.00
	6,100.71
June 30, 1893, amount expended during fiscal year	3,067.12
July 1, 1893, balance unexpended	3,033.59

Amount (estimated) required for preservation of improvement	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 4.)

5. Pascagoula River, Mississippi.—The channel over the bar before the improvement commenced had a least depth of 3 feet. This was increased to 7½ feet with a width of 180 feet by dredging from 1878 to 1880 at a cost of about $42,500. From the light-house near the mouth of the river to its head there was a navigable channel obtained by the

removal of snags and overhanging trees from 1881 to 1884 inclusive, at a cost of about $15,000.

The present project for the improvement of this river was adopted in 1886, the object being to afford a channel of navigable width and minimum depth of 12 feet at mean low water from Moss Point down to the anchorage in the sound, and to maintain the river above Moss Point in its improved condition at an estimated cost of $78,100 for the channel from Moss Point down, and $2,500 annually for preservation of improvement above Moss Point.

The amount expended to June 30, 1892, was $77,141.46 and resulted in the completion of more than one-third of the work needed to complete the project from Moss Point down to the anchorage in the sound.

The officer in charge reports that it has been necessary to increase the estimate for completion of this work owing to the hardness of a portion of the material to be dredged.

The amount expended during the fiscal year ending June 30, 1893, was $20,954.49 and resulted in the removal of 99,977 cubic yards of material from the lower reach of the dredged channel south of the bar below the mouth of Pascagoula River.

July 1, 1892, balance unexpended	$1,733.16
Amount appropriated by act approved July 13, 1892	20,000.00
	21,733.16
June 30, 1893, amount expended during fiscal year	20,954.49
July 1, 1893, balance unexpended	778.67
Amount (estimated) required for completion of existing project	49,000.00
Amount (estimated) required for preservation of improvement above Moss Point	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	69,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix Q 5.)

6. Chickasahay River, Mississippi.—At the time of the adoption of the present project the channel was only navigable for small rafts during high water, and was difficult and troublesome for them. The minimum width of the channel is 50 feet, and the minimum depth 0.5 foot at extreme low water. The project for the improvement of this river was adopted in 1890, the object being to obtain a good high-water channel from the mouth up to the railroad bridge near Shubuta by the removal of snags, logs, and overhanging trees, etc., at an estimated cost of $30,000.

The amount expended during the fiscal year ending June 30, 1892, was $4,595.27, and resulted in giving a high-water channel that allows much larger rafts than formerly to be brought downstream with comparative ease.

The amount expended during the fiscal year ending June 30, 1893, was $1,851.19 and resulted in improving the high-water channel already obtained so as to allow much larger rafts of logs and timber at a considerable lower stage of water, to be floated downstream with safety.

July 1, 1892, balance unexpended	$404.73
Amount appropriated by act approved July 13, 1892	5,000.00
	5,404.73
June 30, 1893, amount expended during fiscal year	1,851.19
July 1, 1893, balance unexpended	3,553.54

Amount (estimated) required for completion of existing project	$20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 6.)

7. Bluff Creek, Mississippi.—At the time of the adoption of the present project navigation was obstructed by overhanging trees and logs.

The minimum width of the river is 100 feet and the minimum depth 10 feet.

The project for the improvement of this creek was adopted in 1890, the object being to obtain a channel from the mouth up to Vancleaves by the removal of snags, logs, and overhanging trees, at an estimated cost of $1,000.

The amount expended during the fiscal year ending June 30, 1892, was $999.51, and resulted in the completion of the project.

July 1, 1892, balance unexpended	$0.49
June 30, 1893, amount expended during fiscal year	.49

(See Appendix Q 7.)

8. Leaf River, Mississippi.—At the time of the adoption of the present project the river was not navigable on account of snags, logs, and overhanging trees.

The minimum width of the river channel is 100 feet and the minimum depth 2.5 feet.

The project for the improvement of this river was adopted in 1890, the object being to obtain a high-water channel from the mouth to the mouth of Bowie Creek by the removal of snags, logs, and overhanging trees, at an estimated cost of $25,000.

The amount expended during the fiscal year ending June 30, 1892, was $4,597.86, and resulted in giving a high-water channel from Hattiesburg to Augusta, Miss., a distance of 40 miles.

The amount expended during the fiscal year ending June 30, 1893, was $527.92, and resulted in giving a high-water channel from the mouth up to Doddrills Landing, a distance of 15 miles.

July 1, 1892, balance unexpended	$402.14
Amount appropriated by act approved July 13, 1892	5,000.00
	5,402.14
June 30, 1893, amount expended during fiscal year	527.92
July 1, 1893, balance unexpended	4,874.22

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 8.)

9. Harbor at Biloxi, Miss.—The original condition of the channel was such as to allow vessels of 5-foot draft to enter the harbor.

The present project for the improvement of this harbor was adopted in 1882, the object being to afford a channel of entrance from Mississippi Sound to the wharves of Biloxi of navigable width and 8 feet deep at an estimated cost of $55,000.

The amount expended to June 30, 1892, was $34,148.64 and resulted in dredging a channel 9 feet at mean low water and 120 feet wide throughout and completion of the project.

During the fiscal year ending June 30, 1893, $2,227.20 was expended

and resulted in the removal of 12,678 cubic yards of material from the lower reach of the dredged channel.

About $8,000 every four or five years will be ample for preservation of the improvement:

July 1, 1892, balance unexpended		$10,851.36
June 30, 1893, amount expended during fiscal year		2,227.20
July 1, 1893, balance unexpended		8,624.16
July 1, 1893, outstanding liabilities	$228.19	
July 1, 1893, amount covered by uncompleted contracts	8,395.97	
		8,624.16

(See Appendix Q 9.)

10. Pearl River, below Jackson, Miss.—The original condition of the navigable channel of this portion of the river was such as to allow navigation only during high water, and then it was difficult and dangerous. The minimum width of the stream was 190 feet, except through Holmes Bayou, which was only 65 feet wide. The minimum width of the channel was 65 feet. The minimum depth of the channel at low water was 1½ feet.

The original project for the improvement of this portion of the river was adopted in 1880, the object being to obtain a 5-foot channel at low water, at an estimated cost of $95,940.

A clear 5-foot channel at low water was found to be impracticable, but a 2-foot clear channel could be obtained.

This amendment to the original project was approved in 1885.

The amount expended on the work up to June 30, 1892, was $116,262.23.

The condition of this part of the river on June 30, 1892, was such as to allow light-draft boats to navigate from the mouth at the Rigolets, La., to Wheats Fields, Miss., 106 miles, all the year from Wheats Fields to Columbia, Miss., 50 miles, on a 6-foot rise, and from Columbia, Miss., to Jackson, Miss., 169 miles, on a 7-foot rise. During the fiscal year ending June 30, 1893, the amount expended was $3,902.33, and resulted in an increased depth of 4 inches at low water from the mouth up to Latins Bluff, 126 miles, and a total width of 150 feet through Holmes Bayou.

July 1, 1892, balance unexpended	$11,862.77
Amount appropriated by act approved July 13, 1892	15,000.00
	26,862.77
June 30, 1893, amount expended during fiscal year	3,902.33
July 1, 1893, balance unexpended	22,960.44
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 10.)

11. Pearl River, between Carthage and Jackson, Miss.—The original condition of this part of the river was such as to make navigation almost impossible except in high water.

The minimum width of the river was 100 feet; the minimum width of the channel was 40 feet.

The original project adopted for the improvement of this river consisted in the removal of snags, logs, trees, etc., and was to afford a clear channel of navigable width 5 feet deep at low water from Jackson to Carthage, 105 miles, at an estimated cost of $21,000. A clear 5-foot channel at low water was found to be impracticable by the method

proposed, but a 2-foot clear channel at low water could be obtained and was all that the present commerce of the stream required.

The original estimate was increased $29,000. (See Annual Report for 1887, Appendix Q 2, p. 1336.)

The amount expended on this work up to the close of the fiscal year ending June 30, 1892, was $26,067.38.

The condition of the improvement on June 30, 1892, was such as to allow light-draft boats to navigate safely on a 3-foot stage above low water from Jackson to Carthage.

The results obtained by the improvement of this section of the river during the fiscal year ending June 30, 1893, are an increased depth on account of removal of snags, sunken logs, and trees, and an increased width of at least 10 feet of the channel on account of trimming off points.

There is a large reduction and saving in freights and insurance rates.

July 1, 1892, balance unexpended	$182.62
Amount appropriated by act approved July 13, 1892	5,000.00
	5,182.62
June 30, 1893, amount expended during fiscal year	185.11
July 1, 1893, balance unexpended	4,997.51
Amount (estimated) required for preservation of improvement	2,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,400.00

(See Appendix Q 11.)

12. Pearl River, between Edinburg and Carthage, Miss.—The original condition of this portion of the river was such that navigation at low water was impossible, and even during high water it was difficult and dangerous.

The minimum width of the channel was 20 feet; the minimum depth at low water was 8 inches.

The project for the improvement of this portion of the river, adopted in 1884, was to afford a high-water channel from Edinburg to Carthage, a distance of 24¾ miles, for six or eight months of the year, at an estimated cost of $13,464.

The amount expended on this work up to June 30, 1892, was $12,375.70.

The condition of this part of the river on June 30, 1892, was such as to allow light-draft boats to navigate with comparative safety from Edinburg to Carthage on a 4½-foot rise above ordinary low water.

The amount expended during the fiscal year ending June 30, 1893, was $2,351.89, and resulted in an increased width of 10 feet and an increased depth of 1 foot.

The project is completed.

July 1, 1892, balance unexpended	$2,374.30
Amount appropriated by act approved July 13, 1892	500.00
	2,874.30
June 30, 1893, amount expended during fiscal year	2,351.89
July 1, 1893, balance unexpended	522.41
Amount (estimated) required for preservation of improvement	500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	500.00

(See Appendix Q 12.)

13. Bogue Chitto, Louisiana.—The channel at present is not navigable at ordinary low water, it being obstructed by snags, logs, fish-traps, etc.

The minimum width of the stream is 120 feet and that of the channel 80 feet; the minimum depth is 3 feet.

The project for the improvement of this river, submitted in report of examination provided for by river and harbor act of August 11, 1888, was adopted in 1890, the object being to obtain a 3-foot channel during the greater part of the year by the removal of logs, snags, fish-traps, etc., from the mouth up to Alfords Bridge, at an estimated cost of $55,000.

The amount expended during the fiscal year ending June 30, 1892, was $1,000, and was applied to preparation of plant for the work.

The amount expended during the fiscal year ending June 30, 1893, was $2,072.40, and was applied to the construction of a snag boat and a barge.

There is no change in the condition of the river, the work of improvement not having been begun.

July 1, 1892, balance unexpended	$4,000.00
Amount appropriated by act approved July 13, 1892	5,000.00
	9,000.00
June 30, 1893, amount expended during fiscal year	2,072.40
July 1, 1893, balance unexpended	6,927.60

Amount (estimated) required for completion of existing project	45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—April 22, 1893, an allotment of $3,000 was made from the permanent indefinite appropriation provided by section 4 of the river and harbor act of June 14, 1880, for the removal of the wreck of a sunken dry dock in Mobile River, Alabama. The work has not yet been done. (See Appendix Q 14.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. A. N. Damrell, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers.

1. Mississippi Sound, outside of the range of islands off the Mississippi coast, with a view of making an entrance for vessels (Ship Island Harbor).—Maj. Damrell submitted report of examination for deepening entrance of Ship Island Harbor, the locality intended by the act, under date of May 9, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the improvement is worthy of being made by the United States. Maj. Damrell suggests, however, that before anything is done at Ship Island it would be well to await the result of efforts being made to secure Congressional action looking to the improvement of Horn Island Pass. No survey is needed for preparation of project and estimate of cost of improvement. (See Appendix Q 15.)

2. Back Bay, Biloxi, Miss., north of the town of Biloxi and up to town of Handsboro, with a view of removing bars.—Maj. Damrell submitted report of examination under date of May 10, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at present worthy of improvement by the United States. (See Appendix Q 16.)

3. Channel at mouth of Old Fort Bayou, Mississippi.—Maj. Damrell submitted report of examination under date of May 11, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at present worthy of improvement by the General Government. (See Appendix Q 17.)

4. Bar at the mouth of Wolf River, Mississippi.—Maj. Damrell submitted report of examination under date of May 11, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is not at present worthy of improvement by the General Government. (See Appendix Q 18.)

5. Bar at the mouth of Jordan River, Mississippi.—Maj. Damrell submitted report of examination under date of May 11, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States. (See Appendix Q 19.)

6. Pearl River from Edinburg to Lake Burnside, Mississippi.—Maj. Damrell submitted report of examination under date of May 11, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river in this section is worthy of improvement by the General Government up to Yates Bridge. (See Appendix Q 20.)

7. Diversion of Pearl River near Jackson, Miss., through Tan Yard Branch.—Maj. Damrell submitted report of examination under date of May 9, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the proposed diversion is not worthy of being undertaken by the General Government. (See Appendix Q 21.)

INSPECTION OF THE IMPROVEMENT OF THE SOUTH PASS OF THE MISSISSIPPI RIVER.

The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction, by James B. Eads or his representatives, of jetties and other works in the South Pass of the Mississippi River, to secure and maintain a channel through the pass 26 feet deep, and through the jetties 26 feet deep and 200 feet wide at bottom, with a central depth of 30 feet; an annual payment of $100,000 was provided for the maintenance of such a channel for twenty years after first obtaining it by the works built. The required channels were secured in July, 1879.

The object of the examinations and surveys of the South Pass, the expenses of which are now provided for by the permanent indefinite appropriation made by act of August 11, 1888, is to determine if the channel is maintained as required by law and to enable the inspecting officer to issue the certificates required for the quarterly payments. The officer in charge of these surveys is Maj. James B. Quinn, Corps of Engineers, whose annual report thereon and on work done during the year is submitted as Appendix R.

The principal work on the jetties during the year consisted in the construction of wing-dams and repairs to the inner lines of jetties. Some additions were made to the outer line of east jetty.

Considerable shoaling took place at the head of the passes during high river, and eventually extended into South Pass, causing the depth

in the channel at a point 1⅞ miles below the head of the passes lighthouse to become less than the required "navigable depth of 26 feet" for a period of twenty-six days.

July 1, 1892, balance unexpended	$799.10
Amount allotted under act of August 11, 1888	10,000.00
	10,799.10
June 30, 1893, amount expended during fiscal year	8,946.73
July 1, 1893, balance unexpended	1,852.37
Amount allotted under act of August 11, 1888	10,000.00
July 1, 1893, balance available	11,852.37

(See Appendix R.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

This district was in the charge of Maj. James B. Quinn, Corps of Engineers; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Chefuncte (Tchefuncte) River and Bogue Falia, Louisiana.—Previous to improvement these streams were obstructed by snags, logs, and overhanging trees. The bar at the mouth of the river had a depth of water of about 4½ feet at the lowest stage.

The project for the improvement of the river was adopted in 1880, and contemplated the removal of obstructions in the channel and the dredging of the bar at its mouth, and was modified in 1884 so as to provide for the building of a breakwater across the bar.

With the first two appropriations of $1,500 each, made in 1881 and 1882, the obstructions were removed below Covington, and part of the unexpended balance was used for constructing 820 feet of the breakwater, but the bar at the mouth was not dredged, as it would be likely to reform.

To prevent this or retard its reformation the officer in charge in 1884 recommended building a breakwater extending 2,500 feet into the lake and then dredging a channel through the bar.

The original estimated cost of the improvement was $5,460, but this did not provide for building the breakwater.

Under the appropriation of $2,500 made in 1886, channels 5 feet in depth and 30 to 60 feet wide were cut through the bars on the Bogue Falia between Old Landing and Covington, giving better navigation for schooners to and from Covington.

Under the appropriation of $1,000 made in 1890, work was commenced in October, 1891, with the Government snagging plant and hired labor.

The river was cleared of logs, snags, impending trees, and other obstructions, from Madisonville to Old Landing, and from the latter place to Covington, on the Bogue Falia, as far as the available funds would permit. Work was discontinued November 30, 1891, and the plant laid up at Madisonville.

The total amount expended on these streams to June 30, 1892, was $6,289.26. The river was then navigable for steamers drawing 5 feet, to Old Landing, about 12 miles above its mouth, and then for the lighter-draft schooners to Covington, about 2 miles farther up on the Bogue Falia. The bar at the mouth of the river has a depth of about 5 feet at low water.

No work was done during the year just closed, beyond repairing the plant, the cost of which was $469.48.

July 1, 1892, balance unexpended	$210.74
Amount appropriated by act approved July 13, 1892	1,000.00
	1,210.74
June 30, 1893, amount expended during fiscal year	469.48
July 1, 1893, balance unexpended	741.26
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix S 1.)

2. Tickfaw River and its tributaries, Louisiana.—When the project for improvement was adopted the Tickfaw River and its navigable branches were obstructed by snags, sunken logs, and trees.

Congress authorized an examination of this river in 1879. A project was submitted in 1881 to clean out the river and its principal tributaries, the Natalbany, Blood, and Pontchatoula rivers, by removing the obstructions, at an estimated cost of $10,230.

To June 30, 1891, the appropriations made by Congress in 1881, 1882, 1886, and 1888, aggregating $7,000, had been expended. Twenty miles of the Tickfaw, and the Natalbany to Springfield, the head of navigation, had been improved. Work was also done on the Pontchatoula as far as it was thought advisable, and the Blood River had been cleaned out as far as navigable.

Under the appropriation of $1,000 made September 19, 1890, work of removing the obstructions that had reformed since 1889 was commenced September 14, 1891, with hired labor and the use of the Government snagging plant, which had but recently finished work on the Amite River. Operations were discontinued in October of that year.

Snags, overhanging trees, and logs were removed from the Tickfaw, Natalbany, and Blood rivers, the latter being cleared to the head of navigation. The extent of channels improved on the three rivers was about 39 miles.

To the close of the year ending June 30, 1892, there had been expended on these streams the sum of $7,777.96. The work done has resulted in a very material increase in the commerce of the river. Most of the shipments are made direct to New Orleans.

Under the appropriation of July 13, 1892, work was commenced at the mouth of the river on December 20, 1892. The results of operations during the fiscal year was the improvement of about 30 miles of channel by removing obstructions, at a cost of $1,018.34.

Obstructions will continue to form in all these streams, and the improvement, therefore, is not permanent. It is estimated that $1,000 will be required annually to keep the channels in good condition.

July 1, 1892, balance unexpended	$222.04
Amount appropriated by act approved July 13, 1892	1,000.00
	1,222.04
June 30, 1893, amount expended during fiscal year	1,018.34
July 1, 1893, balance unexpended	203.70
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,000.00

(See Appendix S 2.)

3. Amite River and Bayou Manchac, Louisiana.—Before improvement was commenced the Amite River and Bayou Manchac, its principal tributary, were navigable by the ordinary river steamboat below and for a short distance above their point of junction; but the navigation was very much impeded and endangered by snags, stumps, impending trees, etc.

In 1880 a project was adopted for the improvement of the Amite River, providing for a low-water channel 5 feet in depth as far up stream as appropriations would permit, the main part of the work to be done above the mouth of the Bayou Manchac. An effort was made to do the work by contract, but the results were unsatisfactory, and in 1883 the original project was modified so as to permit the use of the Government plant and hired labor, the improvement to be made below the mouth of the Bayou Manchac.

Under the appropriation of September 19, 1890, the work of improvement was continued from July 1 to August 29, 1891, with the Government snagging plant. Obstructions were removed from the bayou between its mouth and Hope Villa, and from the river between its mouth and the junction with Bayou Manchac The extent of channel improved during this time was about 13 miles.

There had been expended on the improvement of these streams to June 30, 1892, the sum of $23,628.15. At that date vessels drawing feet of water could navigate the bayou from its mouth to Wards Creek, on the Bayou Manchac, and the river was navigable for vessels of like draft from the mouth to its junction with the Bayou Manchac; but navigation on both streams was somewhat hampered by obstructions which had found their way into the channels since operations ceased in 1891.

July 13, 1892, an appropriation of $2,500 was made for maintenance, $1,000 of which was to be used to construct a turning basin for boats at or near the mouth of Wards Creek on Bayou Manchac As this sum, $1,000, was not deemed sufficient with which to dredge out this turning basin, it has been held for further increase.

After thoroughly repairing the snagging plant used on this improvement, work was commenced November 17, 1892, with the remainder of the appropriation, at Wards Creek, on Bayou Manchac, and was carried on to Port Vincent, on the Amite River, removing the most dangerous obstructions, and resulting in improving about 20 miles of channel, giving much relief to the navigation of the river and bayou. Operations were discontinued on December 15 following.

The amount expended on the improvement of these streams during the year ending June 30, 1893, was $1,415.85.

Owing to the caving of the banks of these streams, the permanent improvement is hardly possible, and about $2,500 will be required annually to keep them free of obstructions.

An appropriation of $2,000 is required, in addition to the $1,000 now available, for dredging a turning basin for boats at or near the mouth of Wards Creek on the Bayou Manchac.

July 1, 1892, balance unexpended	$171.85
Amount appropriated by act approved July 13, 1892	2,500.00
	2,671.85
June 30, 1893, amount expended during fiscal year	1,415.85
July 1, 1893, balance unexpended	1,256.00

(Amount that can be profitably expended in fiscal year ending June 30, 1895 $4,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix S 3.)

4. Bayou Lafourche, Louisiana.—Prior to 1879 the navigation of the Bayou Lafourche was very much obstructed by snags, logs, raft heaps, impending trees, and wrecks.

In 1879 a project was approved for the removal of these obstructions, and work under this project was carried on until 1885.

In 1888 Congress appropriated $50,000 for the improvement of the bayou on the plan of Lieut. Crosby, Corps of Engineers, dated June 11, 1886, and provided for dredging for the immediate relief of low-water navigation.

Lieut. Crosby's project was for a lock at the head of the bayou, connecting it with the Mississippi River, and subsequent dredging of the bayou channel to a width of 75 feet, with a depth of 5 feet at mean low water of the gulf. The estimated cost was $450,000, with an annual expenditure of $8,000 for operation and maintenance.

The act of September 19, 1890, appropriated $50,000 for this stream, and also provided for immediate dredging to secure low-water navigation. July 13, 1892, an appropriation of $50,000 was made for continuing improvement and removing obstructions.

Under the provision of the act of August 11, 1888, dredging was commenced at the head of the bayou, and has been continued since at intervals. There had been expended on the improvement of this stream to June 30, 1892, the sum of $73,343.80, with considerable benefit to the low-water navigation. At that time flatboat navigation was rendered practicable during low water for a distance of 32 miles.

The high water having subsided, the work of improvement was resumed on August 27, 1892, and continued until April 14, 1893, when operations were again suspended on account of the high water. During this time dredging was done between Donaldsonville and the mouth of the bayou, and numerous stumps, logs, snags, and wrecks were removed from the channel, enabling planters to float their crops and merchandise by flatboats during the entire period. The amount expended on this work during the year ending June 30, 1893, was $31,990.73.

Dredging is a very unsatisfactory method of improvement, as much of the work has to be gone over again after the subsidence of the flood in the Mississippi River. If the lock was constructed, whatever dredging was thereafter done would be practically permanent and the certainty and safety of the navigation of the bayou assured.

July 1, 1892, balance unexpended	$56,656.20
Amount appropriated by act approved July 13 1892	50,000.00
	106,656.20
June 30, 1893, amount expended during fiscal year	31,990.73
July 1, 1893, balance unexpended	74,665.47

Amount (estimated) required for completion of existing project	350,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

(See Appendix S 4.)

5. Bayou Terrebonne, Louisiana.—When work was commenced in 1880, Bayou Terrebonne was little better than a drainage ditch, being about 11 feet wide when dredging began.

The project called for the dredging of a channel 4 feet deep at mean low water of the Gulf to Houma. The cost of the improvement of this bayou was estimated at $38,800. The completion of the work to Houma as projected cost $35,808, enabling planters to ship their merchandise to Houma or else to New Orleans by connecting bayous and canals.

July 1, 1882, balance unexpended	$2,992
Juiy 1, 1893, balance unexpended	2,992

(See Appendix S 5.)

6. Bayou Plaquemine, Grand River, and Pigeon Bayou, Louisiana.—The work of securing the mouth of Plaquemine Bayou from further caving is under the charge of Capt. John Millis, Corps of Engineers, whose annual report thereon is submitted as Appendix T. A summary of the work done under his direction is given below, page 252.

Previous to the closing of the mouth of Bayou Plaquemine by a dam, in 1867 or 1868, the largest steamboat passed through it into Grand Lake and the numerous water routes connected with it.

In 1885 a project was proposed for reëstablishing this water route by building a lock at the head of the bayou and dredging out the channel below. In 1888 $100,000 was appropriated for improving the bayou and protecting the bank at its mouth from caving; $75,000 of this sum was allotted to bank protection at the mouth; the remainder has been devoted to dredging out the bayou, so as to give a channel 60 feet wide and 6 feet deep at mean low-water level of the Gulf.

This dredging progressed until, at the end of June, 1891, it had nearly reached the railroad bridge. The cut was about 5 miles long and 30 feet wide, and $16,948.31 had been expended on this work at that time.

During the following fiscal year the dredging was continued until the bridge was reached, and since the draw in this bridge had not been completed the dredge turned back and widened the cut to 60 feet for a distance of about one-half mile from the bridge. The amount expended on this work during the year ending June 30, 1892, was $5,846.41.

The proposed channel is incomplete and, until the lock at the head of the bayou is built, of but little service to navigation and liable to deteriorate.

In 1890 $100,000 was appropriated for continuing the improvement. Of this sum $60,000 was allotted for bank protection at the mouth. A project for the expenditure of the remainder by commencing work upon the lock was presented, but as the lock proposed by a Board of Engineer officers was estimated to cost $700,000, the sum available was held for increase by further appropriation by Congress.

The total expended on this improvement to June 30, 1892, from funds allotted to this office, was $23,830.72.

In 1892 $150,000 was appropriated for continuing the improvement, of which $10,000 was for improving Grand River and Pigeon bayous.

Under this latter considerable improvement has been made in Grand River and measures are on foot for the improvement of Pigeon bayous.

The amount expended on this work during the year ending June 30, 1893, was $8,821.83.

The property needed for the site and approaches to the lock at Plaquemine has been expropriated, but the amount available for commencing work on the lock was not considered sufficient to carry it to a point of safety and the balance is held for increase.

The money statement following is for the entire work on Bayou Plaquemine, the amounts for securing the mouth of the bayou from further caving (page 252) being included:

July 1, 1892, balance unexpended	$73,287.09
Amount appropriated by act approved July 13, 1892	150,000.00
	223,287.09
June 30, 1893, amount expended during fiscal year	12,854.18
July 1, 1893, balance unexpended	210,432.91
July 1, 1893, outstanding liabilities	32,930.33
July 1, 1893, balance available	177,502.58
Amount (estimated) required for completion of existing project	1,358,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix S 6.)

7. *Bayou Courtableau, Louisiana.*—At the time of the adoption of the present project the back water from the Atchafalaya River formed a large sand deposit, known as Little Devil Bar, at the mouth of the Courtableau.

The approved project of 1880 contemplated the closing of some run-out bayous in order to confine the water in the Courtableau and cause its current to wash out the bar at its mouth; after this was accomplished, then to construct a timber lock and dam to give slack-water navigation to Washington, La. In 1883 the estimate was increased to $78,500, and provided for a masonry lock.

Up to June 30, 1892, the sum of $30,781.70 had been expended in closing run-out bayous, with the effect of partially removing the bar.

In 1890 $2,200 was appropriated. With this money work was commenced September 8, 1891, and continued until November 20 of that year, using the Government plant and hired labor. During this time the dams at Bayous Cane, Mamzelle, and Big Fordoche were all repaired with piles and sheet piles, brush aprons being placed above and below them, and all were left in good condition. The sum of $260.85 has been expended on this improvement during the year ending June 30, 1893. Nothing has been done during the past year beyond the care and preservation of the plant.

Little Devil Bar has washed out considerably under the influence of the dams so as to give a navigable depth at a stage of water in the Atchafalaya River 7 feet below the level at which navigation was interrupted in the summer of 1891, but it is considered doubtful if, with all the run-out bayous closed, a channel navigable at low water can be maintained over this bar which, under any circumstances, will certainly form at each high water of the Atchafalaya.

The dams are in fair condition, but the older ones will require extensive repairs in another year.

The success of the dams so far built appears to warrant their maintenance, and the permanent closure of the remaining run-out bayous.

There seems to be sufficient water in the bayou to wash out the bar at its mouth, formed by the backwater of the Atchafalaya, if it can be held within the banks which the closure of the run-out bayous by dams appears to affect.

July 1, 1892, balance unexpended	$418.30
June 30, 1893, amount expended during fiscal year	260.85
July 1, 1893, balance unexpended	157.45
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	5,000.00

(See Appendix S 7.)

8. Bayou Teche, Louisiana.—Previous to improvement the bayou had a navigable depth of about 8 feet, but the channel was obstructed by snags, logs, impending trees, and wrecks.

The project adopted contemplated the removal of these obstructions, and money having been appropriated the stream was thoroughly cleared from Port Barre down.

In 1886 this work was completed, but further obstructions had formed in the bayou since then, and in 1890 an appropriation of $5,000 was made with which to accomplish their removal, the work to be confined to that portion of the stream between the mouth and St. Martinsville.

Work under this appropriation was commenced by hired plant on October 12, 1891, and continued until December 10 of that year, resulting in the improvement of about 59 miles of channel from St. Martinsville down, and giving much relief and satisfaction to the commerce the bayou.

No work was done during the past year

The amount expended on the improvement of this stream to June 30 1892, was $54,349.16.

Sunken logs, fallen trees, and coal-boat wrecks are continually forming obstructions in the bayou, consequently the improvement can not be considered as permanent.

The stream is also obstructed at present by shoals, caused by materia being washed into the channel by drainage ditches. The navigable depth over these bars at times during the low-water season is not more than 3 feet.

July 1, 1892, balance unexpended	$650.84
June 30, 1893, amount expended during fiscal year	38.33
July 1, 1893, balance unexpended	612.5
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	30,000.00

(See Appendix S 8.)

9. Connecting Bayou Teche with Grand Lake at Charenton, La.—The original project was adopted in 1880, the object being to connect Bayou Teche with Grand Lake at Charenton by the construction of a canal a little over a mile long, 50 feet wide and 5 feet deep, with a lock at one end, estimated to cost $75,000. This was modified on further study and examination, and it was found to cost no more to dig a canal 100 feet wide, of same depth, on which no lock would be necessary. The latter is the more desirable project. The amount expended to date is $2,899.95, which was for examinations, surveys, and engineering and office expenses.

The officer in charge states, in the last report submitted on this subject, that the work, if constructed, will be of local benefit only; will save 75 or 80 miles of transportation for logs and rafts, and that no advantage can be derived even by these, until the completion of the

canal. He therefore suggested that the work be not commenced until the amount necessary for its completion, viz, $75,000, is available.

July 1, 1892, balance unexpended	$22,100.05
July 1, 1893, balance unexpended	22,100.05

Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

10. Channel, bay, and passes of Bayou Vermillion, Louisiana.—Bayou Vermillion was at one time navigated throughout its length, but since the construction of the Southern Pacific Railroad the navigation has been confined to that portion below the railroad bridge.

A preliminary examination of the bayou, bay, and passes was made in January, 1891. At that time the upper 12 miles of the bayou had not a navigable depth of much over 2 feet, and below that the depth was not less than 5½ feet through the bayou, bay, and passes. The width of the bayou was from 100 to 400 feet.

The approved project of 1892 contemplated the removal of obstructions such as snags, sunken logs, and impending trees in the bayou, and the marking of the channel through the bars in the bay with guide piles. The estimated cost of the improvement, to provide for 5½ feet depth of water up to the railroad bridge, was $25,000.

July 13, 1892, Congress made an appropriation of $7,500 for this work. Work under contract was commenced December 1, 1892, at a point about 18 miles above the mouth, improving 37½ miles of channel and scouring a depth of 5½ feet over that portion of channel improved by removing snags, logs, overhanging trees, and other obstructions.

The snagging part of the contract was completed March 9, 1893, and by reason of the force and violence of the elements an extension of time was granted the contractor for driving the guide piles in Vermillion Bay.

There has been expended on this work to June 30, 1893, the sum of $5,923.20

Amount appropriated by act approved July 13, 1892		$7,500.00
June 30, 1893, amount expended during fiscal year		5,923.20
July 1, 1893, balance unexpended		1,576.80
July 1, 1893, outstanding liabilities	$623.12	
July 1, 1893, amount covered by uncompleted contracts	518.74	
		1,141.86
July 1, 1893, balance available		434.94

Amount (estimated) required for completion of existing project	17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix S 9.)

11. Mermentau River and tributaries, Louisiana.—A survey of this river, including its tributaries and course through Lake Arthur and Grand Lake to the Gulf of Mexico, was made in 1891. At that time the least depth at Viterboville and for a distance of 5 miles below that point was 7 feet; thence to Lake Arthur the depth was not less than 30 feet. Through Lake Arthur the channel had a minimum depth of 7 feet. From Lake Arthur to Grand Lake the least depth was 24 feet. Through Grand Lake the uniform depth was 6 feet. Immediately below Grand Lake the river was 30 feet deep, but the depth from that

point to the mouth gradually decreased. At the mouth inside the depth was 13 feet. About 5 miles above the mouth, at the head of a lake, occurred a shoal, through which a channel was found of 7 feet, available for steamers, but too crooked for sailing vessels which could not carry more than 5 feet over the flats. All the soundings were referred to mean low tide in the Gulf.

The stream had a width of 70 feet at Viterboville, and maintained the same width for a distance of 7 or 8 miles, where it began to gradually widen until at the mouth of the Nezpique it attained a width of 250 feet. From that point to Lake Arthur the Mermentau River was generally 350 feet wide.

In 1892 a project was approved which contemplated the removal of obstructions such as logs, snags, and overhanging trees in the upper river and a mud flat in the lower; the removal of this flat to be accomplished by brush wing dams. The cost of improving this stream from Viterboville, on the Bayou Nezpique, to the mouth of the Mermentau River, was placed at $23,615.25.

July 13, 1892, an appropriation of $7,500 was made for this improvement.

Work under this appropriation was commenced December 8, 1892, with hired plant under contract at the lower end of Lake Arthur and was carried on up the Mermentau River, improving about 38 miles of channel by removing snags, overhanging trees, etc., materially lessening the dangers of navigation on that portion of the stream which is most used. Work ceased on March 7, 1893.

The amount expended on this work to the close of the year ending June 30, 1893, was $7,054.03.

Amount appropriated by act approved July 13, 1892	$7,500.00
June 30, 1893, amount expended during fiscal year	7,054.03
July 1, 1893, balance unexpended	445.97
Amount (estimated) required for completion of existing project	16,115.25
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1865 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix S 10.)

12. Mouth and passes of Calcasieu River, Louisiana.—Previous to improvement there was not to exceed 3 feet depth over the bars in Calcasieu Lake.

In 1888 $10,000 was appropriated for this work, but as the permanency of the channels required that they be protected by a revetment of some kind, this sum was deemed as entirely too small and was held for further increase.

In 1890 $75,000 was appropriated for the improvement of the mouth of the Calcasieu River, but as the kind of construction indicated in the act could not be safely undertaken with so small a sum it was also held for further increase.

The approved project contemplates the dredging of suitable channels 12 feet deep through the head and foot of Calcasieu Lake and revetting these channels to prevent the return of the dredged material, and to build parallel piers of brush and stone at the entrance to the outer pass, extending from the shore on either side to the deep water of the Gulf, and to dredge between these piers, if necessary. The estimated cost of the improvement was placed at $600,000.

To June 30, 1892, there had been expended on the improvement of this stream the sum of $46,564.60.

In 1892 $100,000 was appropriated for the improvement of the river and pass, and contracts were accordingly let for the construction of a jetty upon the east side of the channel across the bar in the Gulf, and for the construction of a revetment to protect a channel to be dredged through the bar at the head of the pass.

Bids were invited for the dredging, but none were received which were deemed reasonable, and accordingly this work will be done by the Government dredge.

The revetment will be about completed in July and dredging will commence at once.

The east jetty has only been built out a distance of 1,104 feet from the shore, owing to very unfavorable weather.

The amount expended on this work during the year ending June 30, 1893, was $9,898.35.

The improvement when completed will be of considerable benefit to commerce, and, besides the deepening of the water across the bar in the Gulf, will permit vessels to enter the pass for refuge during stormy weather.

July 1, 1892, balance unexpended		$84,935.40
Amount appropriated by act approved July 13, 1892		100,000.00
		184,935.40
June 30, 1893, amount expended during fiscal year		9,898.35
July 1, 1893, balance unexpended		175,037.05
July 1, 1893, outstanding liabilities	$10,231.31	
July 1, 1893, amount covered by uncompleted contracts	135,386.67	
		145,617.98
July 1, 1893, balance available		29,419.07
Amount (estimated) required for completion of existing project		425,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		350,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of the sundry civil act of March 3, 1893.		

(See Appendix S 11.)

13. Harbor at Sabine Pass, Texas.—Originally there was scarcely 6 feet depth of water on the bar at the entrance to Sabine Pass, and as the bar was composed of very soft mud all efforts to maintain a channel through it of 12 or 16 feet depth by dredging were unavailing.

In 1882 a project for the improvement of this entrance was approved. It provided for the construction of jetties on either side of a channel connecting the deep water of the pass with that of the Gulf.

The estimated cost of this improvement was $3,177,606.50.

Since the approval of this project there has been appropriated $1,448,750. A total of $1,319,848.48 had been expended to June 30, 1892, of which sum $999,848.48 was expended under the present project.

The east jetty has a total length of 17,100 feet, 16,650 feet of which has been raised to 2 feet above mean high water. The outer 450 feet is foundation work only.

The west jetty has now a length of 12,840 feet, 6,609 feet of which has been raised to 2 feet above mean high water, and the remainder is only built to the level of mean low water and is incomplete.

In the beginning the jetties were built of alternate layers of brush and stone, but the rapid disappearance of the brush led to the adoption of the present method, which is, first to lay a brush mat and then build a riprap structure on this reaching 2 feet above mean high water.

The material between the jetties is not easily eroded by the currents,

and accordingly dredging has been resorted to to expedite the deepening. At present a dredged channel 16 feet in depth extends through the center of the channel span to within 1,500 feet of the end of the east jetty. This channel would have been extended clear through to the 16-foot curve of depth in the Gulf if unfavorable weather had not prevented.

A considerable deepening of the channel has occurred from natural scour, and the manner in which this material has been carried clear of the entrance confirms the belief that a channel dredged beyond the extremities of the jetties will not be obliterated for some time.

At mean low water there is now an unobstructed channel into the pass of over 11 feet. Vessels, however, enter and leave safely drawing 2 feet more than this, owing to the very soft material composing the bar.

The amount expended on this work during the year ending June 30, 1893, was $208,745.31.

July 1, 1892, balance unexpended		$98,901.52
Amount appropriated by act approved July 13, 1892		350,000.00
		448,901.52
June 30, 1893, amount expended during fiscal year		208,745.31
July 1, 1893, balance unexpended		240,156.21
July 1, 1893, outstanding liabilities	$42,411.54	
July 1, 1893, amount covered by uncompleted contracts	171,975.48	
		214,387.02
July 1, 1893, balance available		25,769.19
Amount (estimated) required for completion of existing project		1,728,856.50
Amount that can be profitably expended in fiscal year ending June 30, 1895		1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix S 12.)

14. Sabine River, Texas.—When the improvement of the river was commenced there was a depth of 3½ feet on the bar at its mouth and also above the town of Orange. Logs, snags, etc., above here interfered with navigation. To June 30, 1889, there had been appropriated for this work $34,700, of which $30,760.39 had been expended.

In 1880 a channel 6 feet deep and from 70 to 100 feet wide was dredged through the bar. In 1881 several small cuts, to avoid bends obstructed with logs, were made above Orange.

An examination above Orange showed many snags in parts of the channel, and a project was prepared and contract entered into for the expenditure of the remaining balance in closing both branches of Old River at the head of the Narrows with pile, brush, and earth dams, to throw all the water in the useful channel, and removing the obstructions, such as snags, overhanging trees, etc.

The smaller Old River channel was closed and most of the piles driven for the larger dam, when a sudden rise in the river washed out many piles in the latter. The river remaining so high that satisfactory work could not be done, the contract was extended to the next low-water season.

Work was resumed in September, 1890, and the dams finished, as projected, in December following, completing the project.

The dredged channel over the bar at the mouth is somewhat obstructed by snags, logs, etc., but the depth is now sufficient for the present demands of commerce.

The amount expended on the improvement of this river to June 30, 1892, was $34,613.12.

Under provisions of the river and harbor act of September 19, 1890, an examination of this river from Sabine Lake to Sudduths Bluff was made and a project submitted providing for the removal of obstructions from the river between these points, at an estimated cost of $10,000.

July 13, 1892, Congress appropriated $5,000 for improving Sabine River up to Sudduths Bluff, Texas.

A snagging plant has been contracted for, and work under this appropriation will be commenced July 1, 1893. The amount expended during the year ending June 30, 1893, was $181.92.

After the obstructions in the river between its mouth and Sudduths Bluff are removed about $2,000 will be required annually to keep the stream in navigable condition.

July 1, 1892, balance unexpended	$86.88
Amount appropriated by act approved July 13, 1892	5,000.00
	5,086.88
June 30, 1893, amount expended during fiscal year	181.92
July 1, 1893, balance unexpended	4,904.96
July 1, 1893, amount covered by uncompleted contracts	4,500.00
July 1, 1893, balance available	404.96
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix S 13.)

15. Neches River, Texas.—Before this river was improved the bar at its mouth had only 3 feet of water over it, and navigation was obstructed between Yellow Bluff and Bevilport by snags and fallen trees.

The project adopted for the improvement of this river called for the dredging of a channel over the bar at its mouth and the removal of obstructions from the river between Yellow Bluff and Bevilport. To June 30, 1892, $33,000 had been appropriated for this work, of which $28,842.16 had been expended.

In 1880 a channel was dredged through the bar at the mouth of the river 5 feet deep and 30 to 60 feet in width. In 1882 the river between Yellow Bluff and Bevilport was cleared of obstructions.

The bar at the mouth had again shoaled, so that at extreme low water there was only a navigable depth of about 3 feet. The channel was again dredged to a depth of 5 feet by the Government dredge, which had been at work at Calcasieu Pass, and the work was completed in April, 1889, since which time no work has been done.

The improvement will not be permanent, as the bar will re-form.

July 1, 1892, balance unexpended	$4,157.84
July 1, 1893, balance unexpended	4,157.84

(See Appendix S 14.)

16. Removing sunken vessels or craft obstructing or endangering navigation.—Two coal barges sunk in Bayou Teche, one near Franklin and one near Jeannerette, La., forming obstructions to the navigation of this stream, were authorized to be removed, and the work was accomplished in May, 1893, without expense to the Government. (See Appendix S 15.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. James B. Quinn, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers.

1. *Homochitto River, Mississippi, from its mouth to the Louisville, New Orleans and Texas Railroad Bridge.*—Maj. Quinn submitted report of examination under date of December 7, 1892. He considers the river worthy of improvement within the limits specified; but it is the opinion of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 140, Fifty-second Congress, second session. (See also Appendix S 16.)

2. *Harbor of refuge on Lake Pontchartrain, Louisiana, most suitable point at or near entrance into the old and new basins.*—Maj. Quinn submitted report of examination under date of December 10, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government. No survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 138, Fifty-second Congress, second session. (See also Appendix S 17.)

3. *Bayous Black and Terrebonne, with a view of connecting them between Southdown Plantation and Houma, La., and opening a shorter and safer inland water route from the Mississippi Valley, via Berwicks Bay, to Texas and Mexico.*—Maj. Quinn submitted report of examination under date of December 16, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 158, Fifty-second Congress, second session. (See also Appendix S 18.)

4. *Sabine River from Sudduths Bluff, Texas, to Logansport, La.*—Maj. Quinn submitted report of examination under date of December 8, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river within the limits named is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 139, Fifty-second Congress, second session. (See also Appendix S 19.)

5. *Channel through Sabine Lake from Sabine Pass to mouths of Sabine and Neches rivers, Texas.*—Maj. Quinn submitted report of examination under date of December 10, 1892. He considers the improvement worthy of being undertaken; and it is the opinion of the division engineer, concurred in by this office, that the channel is in some degree worthy of improvement by the United States. Maj. Quinn estimates the cost of a survey necessary for preparation of project and estimate of cost of improvement at $2,500. The report was transmitted to Congress and printed as House Ex. Doc. No. 146, Fifty-second Congress, second session. (See also Appendix S 20.)

6. *Neches River, Texas, from its mouth to Shooks Bluff.*—Maj. Quinn submitted report of examination under date of December 22, 1892. He considers the river worthy of improvement below the mouth of Angelina River; and it is the opinion of the division engineer, concurred in by by this office, that Neches River up to the junction of the Angelina is worthy of improvement by removal of snags and overhanging trees.

No survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 156, Fifty-second Congress, second session. (See also Appendix S 21.)

SECURING MOUTH OF BAYOU PLAQUEMINE, LOUISIANA, FROM FURTHER CAVING.

This work was in the charge of Capt. John Millis, Corps of Engineers; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

Bayou Plaquemine was formerly an outflowing branch of the Mississippi River, but the levee system on the west bank of the Mississippi was carried across the head of the bayou in 1865. It is now proposed to improve and deepen the bayou and establish navigable connection between it and the Mississippi by a system of locks at the head of the bayou.

The west bank of the Mississippi at this point was formerly subject to rapid caving, threatening the site of the proposed locks.

The project adopted for the improvement contemplates a system of submerged spur dikes, built of timber, brush, and stone. They run out at right angles to the general direction of the bank line, and are placed at intervals of about 900 feet.

Up to the close of the fiscal year ending June 30, 1892, there had been expended $53,731.61. Five of the dikes had been finished.

The completed work of protection now extends to a distance of 2,500 feet above and 1,500 feet below the site of the proposed locks, and within this distance the caving of the bank has been arrested.

Some repairs are necessary to the completed bank protection. These repairs will be made during the coming season with funds and material now on hand.

During the year $4,032.35 was expended on this work, leaving an unexpended balance, July 1, 1893, from the funds allotted to this improvement, of $27,085.46. The money statement is consolidated with that for the general improvement of Bayou Plaquemine, Louisiana, page 244.

(See Appendix T.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

This district was in the charge of Maj. Charles J. Allen, Corps of Engineers, to February 8, 1893, and of Maj. A. M. Miller, Corps of Engineers, since March 21, 1893, with Lieut. William C. Langfitt, Corps of Engineers, under their immediate orders, and in the temporary charge of Lieut. Langfitt from February 8 to March 21, 1893; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Entrance to Galveston Harbor, Texas.—The obstructions to deep-water navigation at this harbor have been the outer and inner bars. On the former the natural depth was 12 feet and on the latter about 13 feet, both at mean low tide.

The present project for improvement at this locality was adopted in 1874, modified in 1880, and again modified in 1886, the object being to deepen the channels so as to admit sea-going vessels of the deepest draft. The projects prior to 1874 related to dredging operations on a small scale.

The projects of 1874 and 1880 contemplated construction of jetties to deepen the channels on the bars; the former with a view to a depth of

18 feet. The modification of 1886 was with a view to a possible depth of 30 feet by means of jetties, to be supplemented, if need be, by dredging. These jetties to be of rock and to be built to a height of 5 feet above mean low tide. The cost of the modification of 1886 (the present project) was estimated at $7,000,000.

The total amount expended under the foregoing plans, to include June 30, 1892, was $2,712,843.53, in addition to which there was expended $100,000, subscribed by the city of Galveston in 1883. It has resulted in a depth of 13½ feet in the channel on the outer bar at mean low tide, and a depth of 21 feet where the inner bar was.

The expenditure during the past fiscal year of $646,796.29 has resulted in obtaining 14 feet on the outer bar and 23 feet where the inner bar was, an increase in depth of three-quarters of a foot and 2 feet, respectively.

The work during the past fiscal year has consisted in extending the south jetty 8,000 feet and building an apron 839 feet long at the sea end, which completes this jetty for the present. Work on the north jetty was commenced in April, 1893; 1,500 feet was completed and 2,100 feet was partially completed. The total of work done since operations began in 1887 is represented by 32,829 feet of south jetty, of which 32,000 is completed and 829 feet uncompleted, and 3,600 feet of north jetty, of which 1,500 feet is completed and 2,100 feet uncompleted.

The appropriation asked for the fiscal year ending June 30, 1895, is to be applied to the extension of north jetty and necessary repairs to south jetty

July 1, 1892, balance unexpended		$665,156.47
July 14, 1892, repayment of amount of compromise in suit of J. H. Mooney *et al*		118.00
Amount appropriated by sundry civil act approved August 5, 1892		450,000.00
Amount appropriated by sundry civil act approved March 3, 1893		1,000,000.00
		2,115,274.47
June 30, 1893, amount expended during fiscal year		646,796.29
July 1, 1893, balance unexpended		1,468,478.18
July 1, 1893, outstanding liabilities	$32,138.97	
July 1, 1893, amount covered by uncompleted contracts	1,328,104.33	
		1,360,243.30
July 1, 1893, balance available		108,234.88
Amount (estimated) required for completion of existing project		3,650,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix U 1.)

2. Ship Channel in Galveston Bay, Texas.—This is a channel dredged by the United States Government from Bolivar Channel to Morgan Cut, the latter terminating at a point 4.8 miles from Morgan Canal, an excavation across Morgan Point at the mouth of the San Jacinto River. Morgan Cut and Canal were formerly the property of the Buffalo Bayou Ship Channel Company, but were purchased by the United States and the transfer was made May 4, 1892.

The natural depth on the line of the Galveston Bay Ship Channel averaged 8½ feet at mean low tide, with a depth in some places of but 7 feet; the ruling depth in Morgan Cut was 7½ feet, and in the canal 17 feet.

The project for this improvement was adopted in 1871, modified in 1877, and again modified in 1892. This latter modification became necessary owing to the acquisition by the United States of the Morgan Cut and Canal. The object of the improvement is to excavate and maintain a channel, 100 feet wide at the bottom and 12 feet deep, from Bolivar Channel to the San Jacinto River, a distance of 24.33 miles, thereby giving an outlet to the commerce of Buffalo Bayou, of San Jacinto River, of Trinity River, and of Cedar Bayou.

A channel, having a least width of 100 feet and depth of 12 feet, was excavated from Bolivar Channel to Morgan Cut in 1888 and 1889, this being the first work that was done since operations were suspended in 1883.

No dredging was done from July, 1889, to the end of the last fiscal year; consequently the channel shoaled to an average depth of 8 feet.

The amount expended to June 30, 1892, on this improvement was $540,831.16, and during the fiscal year ending June 30, 1893, the sum of $16,484.64 was expended in sloping the banks at Morgan Canal, which required the removal of 12,550 cubic yards of material, and in completing the revetment on the west bank of the canal, the length constructed being 1,959 linear feet. This work prevented further erosion of the banks of the canal. No dredging was done, the contractor's plant having met with an accident while en route to Galveston, and repairs were not completed at the close of the fiscal year. There was no change in channel depths from those previously reported.

The project is not capable of permanent completion, it being estimated that the sum of $100,000 will be required annually to maintain the channel after it has been fully excavated to the required width and depth.

July 1, 1892, balance unexpended		$45,668.84
Amount appropriated by act approved July 13, 1892		40,000.00
		85,668.84
June 30, 1893, amount expended during fiscal year		16,484.64
July 1, 1893, balance unexpended		69,184.20
July 1, 1893, outstanding liabilities	$851.79	
July 1, 1893, amount covered by uncompleted contracts	55,200.00	
		56,051.79
July 1, 1893, balance available		13,132.41
Amount (estimated) required for completion of existing project		269,675.44
Amount that can be profitably expended in fiscal year ending June 30, 1895		200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix U 2.)

3. Channel in West Galveston Bay, Texas.—The channels through West Galveston Bay were originally dredged in 1859 by the State of Texas to a depth of 5 feet, but during the storm of 1875 they shoaled to a depth of from 2½ to 3 feet at mean low tide, and at the same time became too narrow to allow vessels to pass through them except at full tide. Subsequent storms probably caused further filling of the channels.

The project for this improvement was adopted in 1892 and consisted in widening, deepening, and straightening the channel by dredging, so as to afford a least width of 200 feet and depth of 3½ feet between the railroad bridges and San Louis Pass in the bay, and a least width of 100 feet and depth of 3 feet along Christmas Point, the channel to be marked by suitable beacons. The total estimated cost is $28,998.80.

No money was expended on this improvement up to the close of the fiscal year ending June 30, 1892, consequently there was no change in the condition of the channel, except possibly a further filling due to wind and currents.

The amount expended during the fiscal year ending June 30, 1893, was $2,317.71, mostly in erecting beacons and inspecting dredging done by contract.

The small amount of material removed by the contractor during the year, 2,928 cubic yards, was not enough to benefit commerce to any great extent.

Amount appropriated by act approved July 13, 1892		$15,000.00
June 30, 1893, amount expended during fiscal year		2,317.71
July 1, 1893, balance unexpended		12,682.29
July 1, 1893, outstanding liabilities	$220.00	
July 1, 1893, amount covered by uncompleted contracts	11,500.00	
		11,720.00
July 1, 1893, balance available		962.29
Amount (estimated) required for completion of existing project		14,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		14,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3 1893		8

(See Appendix U 3.)

4. Trinity River, Texas.—The natural channel on the bar across the mouth was narrow and shoal. The project for improvement adopted in 1873 consisted principally in dredging. Between 1885 and 1889 no work was done, and the channel, which had been deepened in 1885 to 5½ feet, had shoaled to 3 feet 2 inches. The project was modified in 1889, the modification principally consisting in parallel timber jetties to effect the required deepening to 6 feet on the bar. The total expended to include June 30, 1892, was $56,119.68, at which time one jetty was nearly completed, resulting in a depth of 3 feet 6 inches on the bar and straightening the channel. The amount expended during the fiscal year ending June 30, 1893, was $627.25, and was used principally in making a survey with a view to preparing project for expenditure of amount appropriated for this work by the river and harbor act of July 13, 1892.

The depth of 3 feet 6 inches over the bar has been practically maintained by the jetty previously constructed.

July 1, 1892, balance unexpended		$880.32
Amount appropriated by act approved July 13, 1892		10,000.00
		10,880.32
June 30, 1893, amount expended during fiscal year		627.25
July 1, 1893, balance unexpended		10,253.07
July 1, 1893, outstanding liabilities		60.18
July 1, 1893, balance available		10,192.89
Amount (estimated) required for completion of existing project		22,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		22,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893		

(See Appendix U 4.)

5. Cedar Bayou, Texas.—The navigation on this stream was obstructed by a bar which had formed at the mouth of the bayou where it emptied into Galveston Bay. The depth of water in the bayou above the bar was 7 feet, and in the bay beyond the bar 5 feet, whereas the natural depth on the bar between the two was but 3 feet.

The project adopted for this improvement consisted in the construction of two stone and brush jetties, about 250 feet apart where they crossed the bar, and extending from the mainland to the 5-foot contour in Galveston Bay. These jetties were to protect a channel having a depth of 5 feet and a width of about 100 feet, which was to be dredged, connecting the 5-foot curve in the bayou with the 5-foot curve in the bay.

The amount expended to June 30, 1892, was $13,258.22, which was applied to dredging a channel on the bar and protecting it by jetties, resulting in a channel 1,840 feet long by 64 feet wide, and having a ruling depth of 5 feet.

The amount expended during the fiscal year ending June 30, 1893, was $11,220.23 and was used in extending the jetties already built. The total amount of jetty constructed was 842 feet; the south jetty having been extended 517 feet and the north jetty 325 feet. Dredging had not been commenced up to the close of the fiscal year. This work has been successful in maintaining the channel previously dredged, and has also slightly increased its depth as well as that on the bar just beyond.

The officer in charge states that the revised estimate of the cost of this work made in 1891 was too small, as proved by experience, and that it will require the further sum of $6,500 to complete it, making the total estimated cost of the work $38,750.

July 1, 1892, balance unexpended	$4,891.78
Amount appropriated by act approved July 13, 1892	14,000.00
	18,891.78
June 30, 1893, amount expended during fiscal year	11,220.23
July 1, 1893, balance unexpended	7,671.55
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	6,500.00

(See Appendix U 5.)

6. Buffalo Bayou, Texas.—The channel of this stream between the city of Houston and Simms Bayou, a distance of 11 miles, was, in its natural condition, narrow and tortuous, and the natural depth in many places was not more than 5 feet. Below Simms Bayou it is wide and deep.

The project for its improvement was adopted in 1881, the object being to straighten the channel, widen it to 100 feet, and deepen it to 12 feet; also to remove such snags, stumps, and overhanging trees as were obstructions to navigation.

The amount expended to June 30, 1892, was $165,803.99. It has resulted in clearing the channel of the most prominent stumps, snags, and overhanging trees, in easing most of the bends, and in removing such shoals as obstructed a 7-foot navigation. The amount expended during the past fiscal year was $7,413.99, and has resulted in a further easement of bends and deepening of the bayou, so that a 10-foot channel is now available in the portion of the bayou worked over this year. Obstructions were also removed from the bed and banks of the stream.

These obstructions are renewed in more or less degree every year through action of floods. The project is not capable of permanent completion.

July 1, 1892, balance unexpended		$2,946.01
Amount appropriated by act approved July 13, 1892		25,000.00
		27,946.01
June 30, 1893, amount expended during fiscal year		7,413.99
July 1, 1893, balance unexpended		20,532.02
July 1, 1893, outstanding liabilities	$4,633.07	
July 1, 1893, amount covered by uncompleted contracts	11,957.98	
		16,591.05
July 1, 1893, balance available		3,940.97
Amount (estimated) required for completion of existing project		191,549.75
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix U 6.)

7. Harbor at Brazos Santiago, Tex.—In its natural state the channel over this bar was shifting and its depth varied from 6 to 8 feet. The present (original) project for its improvement was adopted in 1881, the object being to fix the position of the channel over the bar at the extrance and to deepen it. The total amount expended to June 30, 1891, was $189,608.59, besides an appropriation of $6,000 in 1878 applied to removing a wreck, which resulted in no useful effect upon the bar, and the works heretofore constructed have practically disappeared. The amount expended during the past fiscal year was $60. It was applied to the keeping of a record of commercial statistics.

July 1, 1892, balance unexpended		$57,701.41
June 30, 1893, amount expended during fiscal year		60.00
July 1, 1893, balance unexpended		57,641.41
July 1, 1893, outstanding liabilities		15.00
July 1, 1893, balance available		57,626.41
Amount (estimated) required for completion of existing project		1,071,090.22
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		

(See Appendix U 7.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *Brazos River, Texas, from its mouth to the town of Richmond*, required by act of July 13, 1892, was made by the local engineer, Maj. Charles J. Allen, Corps of Engineers, and his report thereon, dated December 7, 1892, was submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers. Maj. Allen considers that Brazos River is worthy of improvement by the General Government from Richmond downstream to the point near the mouth to which the Brazos River Channel and Dock Company intends to extend its works, provided the cost of improvement, to be determined by a survey, the cost of which is estimated at $2,500, be not out of proportion to the commerce to be benefited. It is the opinion of the division engineer, concurred in by this office, that below Richmond the river is worthy of some degree of improvement by the United States.

The report was transmitted to Congress and printed as House Ex. Doc. No. 136, Fifty-second Congress, second session. (See also Appendix U 8.)

WESTERN RIVERS.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, MISSISSIPPI, AND TENNESSEE, TRIBUTARY TO MISSISSIPPI RIVER; WATER GAUGES ON MISSISSIPPI RIVER AND PRINCIPAL TRIBUTARIES.

This district was in the charge of Capt. J. H. Willard, Corps of Engineers; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Red River, Louisiana and Arkansas.—This improvement was begun in 1828, and appropriations aggregating $535,765.50 were made between 1828 and 1852. Between 1841 and 1852 no appropriation was made, and a longer interval elapsed between 1852 and 1872, during which the results of former work were lost.

The present improvement commenced in 1872, at which time the upper river was closed by the great raft, extending from Carolina Bluffs, 33 miles above Shreveport, La., upstream 32 miles to within 4 miles of the Louisiana and Arkansas line, and added to by each flood. The falls at Alexandria were impassable at low stages. Navigation was affected seriously by the gradual enlargement of Tones Bayou Outlet, 19 miles below Shreveport, which depleted the main channel; and the river was obstructed by snags, sunken logs, wrecks, and leaning trees throughout its entire length.

The project of 1872 contemplated removing the great raft and closing Tones Bayou. Subsequently it was enlarged to include the removal of jams, snags, wrecks, leaning timber, etc.; opening and enlarging the channel through the falls at Alexandria, La.; deepening shoal places, and closing outlets and constructing and repairing levees to confine the river to the adopted channel, in order to improve and keep navigation open from Fulton, Ark., to the head of Atchafalaya River, Louisiana, a distance of 507 miles. Also to protect the banks at Alexandria and Shreveport from erosion, and to make a thorough and comprehensive survey on which to base plans and estimates for permanent improvement.

The amount expended from 1872 to June 30, 1892, was $987,413.99 (including outstanding liabilities of $107.12), resulting in great benefit to navigation. A channel was cleared through the great raft in 1873, opening to navigation 188 miles of river between Shreveport and Fulton, and, at high stages, about 138 miles above Fulton, and subsequent operations, aided by the current, secured a greater width and depth throughout the raft region, with a channel way constantly widening and scouring, from which little water is diverted except at flood stages; the low-water line having fallen more than 15 feet at head of the raft, diminishing to about 3 feet at Shreveport, while a similar reduction has been going on in the river below. Moderate estimates, made in 1872, showed that the removal of the raft alone resulted in an annual saving of at least $150,000 to the planting interest above, besides relieving to a great extent not less than 25,000 acres of productive lands from overflow. The removal of obstructions from the channel, clearing the banks, and prompt breaking of all jams and keeping the drift in motion during high water, have prevented renewal of the raft. No work for the closure of Tones Bayou has been done since 1882, when

the dam under construction was destroyed. That outlet, however, is filling up gradually with drift, which, in connection with the work done in the old raft region above and in the narrow river below, has caused the main channel to widen and scour until not less than two-thirds of the flood water is carried by Red River, where twenty years ago three-quarters escaped through Tones Bayou or over the banks into Bayou Pierre. The rock excavation and dam at the falls of Alexandria, completed in 1885, increased the period of navigation about two months, and as a general thing permitted boats to pass the falls the year round, though with difficulty at low stages. The dam and training wall, built in 1884–'85, for protecting the bank at Alexandria, accomplished the purpose for which intended. The removal of snags and clearing the banks for the general improvement of the river were not begun until 1878, but since 1885 operations were confined chiefly to that class of work, reducing the danger of navigation from an average of about four steamboat wrecks a year to one in over three years. The Sale and Murphy Outlet, at head of the old raft, was closed in 1891 with a heavy earthen dam, which resisted the unprecedented flood of 1892 without sustaining serious damage and caused the channel of the river through the old raft region to scour rapidly. The survey of the river was carried from Fulton, Ark., to the mouth, and checked by a line of precise level from Delta to Shreveport, La., connecting it with the Mississippi and continuing down Red River from Shreveport to the mouth.

In the past fiscal year the removal of obstructions by means of snagboats was continued with benefit to navigation at all stages, and especially at seasons of low water. The river from Fulton, Ark., to mouth of Black River was worked over thoroughly twice, and the most obstructed portions were worked over after each rise and fall, reducing the risks to a minimum and enabling steamboats to make regular trips without hindrance. At Alexandria, La., 10,242 cubic yards of rock was dredged from the channel at the Upper Falls, improving that difficult piece of navigation and leaving only a small amount of dredging to be done to make it safe. The material excavated was transported to Alexandria, and the greater portion used in revetting the caving bank at the town front, which had been graded in advance; the remainder of the material was used in strengthening the crib dike built in 1884–'85 and for commencing a dike at foot of Beauregard street. For confining the river to the adopted channel, 273,385 cubic yards of levees was built by the United States during the year, which incidentally will protect valuable lands from overflow, in conjunction with a much larger amount of levee work done by the State of Louisiana and parish levee boards. Field work of the survey was limited to connecting high-water marks with the main line of levels and established benches, gauge observations, and examinations of local obstructions, cut-offs, outlets, levees, etc. At the office the construction of maps from information already obtained was continued during the year.

The amounts expended during the year were:

For general improvement	$21,486.25
For work at Alexandria	12,617.61
For Little River from Scopini Cut-off to Knox Point	1,147.68
For construction of levees	42,442.46
For survey of Red River	12,872.59
For Sale and Murphy Outlet	8.88
For Cypress Bayou, etc	59.45
Total	90,634.92

July 1, 1892, balance unexpended		$42,693.13
Amount appropriated by act approved July 13, 1892		145,000.00
Received from sales of property to other work		13.83
		187,706.96
June 30, 1893, amount expended during fiscal year		90,634.92
July 1, 1893, balance unexpended		97,072.04
July 1, 1893, outstanding liabilities	$1,676.32	
July 1, 1893, amount covered by uncompleted contracts	4,979.30	
		6,655.62
July 1, 1893, balance available		90,416.42
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		800,000.00

(See Appendix V 1.)

2. Red River above Fulton, Ark.—The project for this improvement, adopted in 1886, contemplated removing snags, drift, etc., above Fulton, Ark., to the mouth of Kiamichi River, Indian Territory, about 138 miles to, give reasonably safe navigation at high and medium stages.

The amount expended to June 30, 1892, was $11,779.26, with which a small hand-propelled snag boat was built and employed in the fiscal years 1888 and 1889 in removing obstructions. In the fiscal year 1891 the snag boat was sold to the work of improving Red River, Louisiana, and Arkansas, for $1,500, and the proceeds of the sale, with the appropriation of 1890, were applied to going over the work and removing snags, drift, and leaning trees, practically completing the project for safe navigation at high stages.

Under the act of 1892 the largest snag boat belonging to the improvement of Red River, Louisiana and Arkansas, was employed in removing obstructions to navigation from January 1 to March 11, 1893. It was found that great improvement in depth of channel had obtained by scour since the last work was done in February, 1891, and, although the stages were near extreme low water, the snag boat, 36 feet beam and drawing 30 inches, crossed the bars without difficulty. Work was carried from Fulton to the mouth of Kiamichi River, and consisted of clearing a safe low-water channel for the passage of the snag boat, which will widen and scour, that being all that could be done with the amount available.

Unless a single appropriation of $10,000 is granted for this part of Red River, to permit the systematic clearing of the banks and channel without interruption, no further work is recommended for the present. This amount could be expended advantageously for clearing banks of caving and sliding trees, to stop accumulations of drift, and in continuing the removal of sunken logs to permit the bottom to scour, and such work would benefit navigation below Fulton also by lessening the source of drift.

July 1, 1892, balance unexpended	$220.74
Amount appropriated by act approved July 13, 1892	3,500.00
	3,720.74
June 30, 1893, amount expended during fiscal year	3,428.09
July 1, 1893, balance unexpended	292.65
July 1, 1893, outstanding liabilities	1.29
July 1, 1893, balance available	291.36

Amount that can be profitably expended in fiscal year ending June 30, 1895	$10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V 2.)

3. Ouachita and Black rivers, Arkansas and Louisiana.—The improvement of Ouachita River commenced in 1871. Black River, the connecting stream between Ouachita and Red rivers, was added under the same head of appropriation by the act of 1884. The original project contemplated improvement by a system of locks and dams, but was abandoned on account of its cost as compared with the amount of commerce then reported. The present project contemplates removing snags, logs, wrecks, leaning timber, etc., and the improvement of shoal places between Camden, Ark., and the mouth of Black River, a distance of 341 miles. No estimate of cost is given, as the nature of the work requires that it be continuous.

The total amount expended to June 30, 1892 (including outstanding liabilities of $13.17), was $340,463.84, of which $226,875.97 was applied to operations under the project of 1874. An iron-hull snag boat was purchased in 1875 and repaired with a new steel bottom in 1886, and a small wooden snag boat was purchased in 1888. From 1875 to the end of the fiscal year 1892 operations were carried on whenever funds were available, and consisted chiefly of the removal of wrecks, snags, logs, and tree slides from the channel, and cutting leaning timber, though an increased depth was obtained at some of the shoals by building stone and brush wing dams.

In the past fiscal year the snag boat *Wagner* worked over Lower Ouachita and Black River, and by the removal of obstructions improved navigation greatly between Monroe, La., and the mouth of Black River. A chopping party worked from Monroe to the Arkansas State line, putting that stretch of river in fairly good condition for navigation at stages when boats can run. The work will be resumed as soon as possible, to remove obstructions brought in by the recent flood.

Since the project for locks and dams was abandoned three examinations have been ordered and made with a view to slack-water navigation, the last in 1889, and the reports on all agree that work should continue under the adopted project until an increase of trade is developed sufficient to justify a large expenditure for permanent improvement.

July 1, 1892, balance unexpended		$2,049.33
Amount appropriated by act approved July 13, 1892		40,000.00
		42,049.33
June 30, 1893, amount expended during fiscal year		11,473.35
July 1, 1893, balance unexpended		30,575.98
July 1, 1893, outstanding liabilities		14.92
July 1, 1893, balance available		30,561.06
Amount that can be profitably expended in fiscal year ending June 30, 1895		186,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix V 3.)

4. Bayous D'Arbonne and Corney, Louisiana.—The project for this improvement was adopted in 1884, and contemplated removing snags, logs, wrecks, leaning timber, etc., obstructing navigation from Stein Bluff, on the Corney Branch, to the mouth of D'Arbonne, 42½ miles, at an estimated cost of $15,000. The river and harbor act of 1892 re-

quired that operations be extended above Stein Bluff to the head of navigation on Bayou Corney, a distance of about 16½ miles. The estimated cost of removing obstructions to navigation in the latter stretch is $7,000.

The amount expended to June 30, 1892, was $10,874.94. Before the improvement commenced the bayou was navigable from six to seven months of the year. The work extended the period of navigation fully one month, enabled boats of double the capacity to make quicker time than those used formerly, with greater safety, reduced freight rates one-half, and extended navigation 16½ miles up the Corney Branch.

No work was done during the fiscal year ending June 30, 1893, on account of the limited period of low water.

The work is not permanent, as new obstructions are brought into the stream from time to time, but it is believed that with the funds now available, $1,000 less than the estimate, the work below Stein Bluff can be completed so as not to need further attention for several years. To complete the work to Cobb Landing, the head of navigation on Bayou Corney, it is estimated will cost $6,000.

July 1, 1892, balance unexpended	$125.06
Amount appropriated by act approved July 13, 1892	4,000.00
	4,125.06
July 1, 1893, balance unexpended	4,125.06
Amount (estimated) required for completion of existing project	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867, and of sundry civil act of March 3, 1893.	

(See Appendix V 4.)

5. Bayou Bartholomew, Louisiana and Arkansas.—This improvement commenced in 1881, the project contemplating the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation between Baxter, Ark., and the mouth, about 150 miles.

The amount expended to June 30, 1892, was $32,651.90. Operations extended over the entire portion of the bayou included in the project, and some of the most obstructed parts were worked over two and three times, but not thoroughly in two seasons, as projected. However, the work performed at intervals has benefited navigation to a great extent. Before the improvement commenced the average duration of the navigable season was three months; now there is better navigation for about six months and boats of double the capacity make trips with greater safety in half the time, and rates of freight are reported to have been reduced 50 per cent.

Nothing was done during the past fiscal year on account of the limited period of low water, but it is intended to resume work with a large party as soon as practicable.

July 1, 1892, balance unexpended	$348.10
Amount appropriated by act approved July 13, 1892	5,000.00
	5,348.10
July 1, 1893, balance unexpended	5,348.10
July 1, 1893, outstanding liabilities	.92
July 1, 1893, balance available	5,347.18
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V 5.)

6. Bœuf River, Louisiana.—The project for improving this bayou was adopted in 1881, and contemplated removing snags, logs, leaning timber, etc., obstructing navigation between Wallace Landing and the mouth, about 152 miles. Three outlets near Point Jefferson, La., were examined in 1884, and their closure recommended.

The amount expended to June 30, 1892, was $30,695.07, enabling steamboats to run to Point Jefferson, 19 miles below Wallace Landing, during high stages, with safety, and below the Vicksburg and Shreveport railroad bridge navigation is safe at any stage high enough to permit boats to cross the bars. The three outlets were closed as securely as possible with the means available in 1887 and 1888, and the work gave immediate benefit to navigation by confining the flow to its natural direction and scouring the bars below, but the dams were destroyed during the overflow from the Mississippi River in the spring of 1890. It is essential that they be rebuilt if navigation in the bayou is to be maintained. The estimated cost of this work is $30,000.

No work was done the past fiscal year on account of the limited low-water season, but the funds available will be expended for the removal of obstructions to navigation as soon as the water falls sufficiently.

July 1, 1892, balance unexpended	$304.93
Amount appropriated by act approved July 13, 1892	10,000.00
	10,304.93
June 30, 1893, amount expended during fiscal year	144.90
July 1, 1893, balance unexpended	10,160.03
July 1, 1893, outstanding liabilities	22.54
July 1, 1893, balance available	10,137.49
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	40,000.00

(See Appendix V 6.)

7. Tensas River and Bayou Maçon, Louisiana.—The project for improving Tensas River was adopted in 1881, and contemplated removing snags, logs, and leaning timber obstructing navigation between Dallas and its mouth, about 134 miles, at an estimated cost of $23,000. Bayou Maçon, a tributary, was added under the same head of appropriation by act of 1884, and the project contemplated removing the same class of obstructions between Floyd and its mouth, about 98 miles, at an estimated cost of $17,000.

The amount expended to June 30, 1892, was $17,980.64, of which $7,529.25 had been applied to the Tensas and $10,451.39 to the Maçon. The obstructions were removed as far as practicable with these amounts, and in Bayou Maçon, the principal commercial branch, had resulted in improved navigation so as to shorten the time of steamboat trips twelve hours.

In the past fiscal year a chopping party worked over Bayou Maçon, from Floyd down to within 16 miles of its mouth. This work was done thoroughly and at a low stage of water, when the majority of obstructions were visible. It reduced the risk of navigation in the bayou to a minimum, and should enable boats to make the trip to Floyd in six to eight hours less time. Lower Tensas River, below the mouth of the Maçon, needs no work at present, and the balance available will be applied to the removal of obstructions in Upper Tensas as soon as the water falls.

New obstructions are added from time to time, but it is believed that with the balance of the original estimate ($14,000), in one appropriation, both streams can be cleared of obstructions so thoroughly as not to need further attention for years.

July 1, 1892, balance unexpended	$3,019.36
Amount appropriated by act approved July 13, 1892	5,000.00
	8,019.36
June 30, 1893, amount expended during fiscal year	6,444.00
July 1, 1893, balance unexpended	1,575.36
July 1, 1893, outstanding liabilities	.38
July 1, 1893, balance available	1,574.98

Amount (estimated) required for completion of existing project	14,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	14,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V 7.)

8. *Big Black River, Mississippi.*—The project for this improvement contemplated removing snags, logs, leaning timber, etc., obstructing navigation between Cox Ferry and the mouth, about 130 miles, at an estimated cost of $32,000.

The first appropriation, by act of 1884, $5,000, was applied to removing the principal obstructions for a distance of 75 miles above the mouth.

The next appropriation, by act of 1886, contained the proviso that no part of the appropriation should be used until the State of Mississippi caused the bridges below the Vicksburg and Meridian Railroad to be so constructed as not to obstruct navigation.

The act of 1890 removed the restriction contained in the act of 1886, and in 1891 the funds were applied to work between Baldwin and Ivanhoe ferries, a distance of about 20 miles.

No work has been done since June, 1891. The funds available will be applied to continuing the removal of leaning timber and snags as soon as the water reaches a low stage.

In view of the small amount of commerce to be benefited, the fact that there is no probability of an increased business for years to come, and the cost of maintaining navigation by the removal of obstructions added every year, no estimate is submitted for continuing this work.

July 1, 1892, balance unexpended	$248.77
Amount appropriated by act approved July 13, 1892	5,000.00
	5,248.77
June 30, 1893, amount expended during fiscal year	162.84
July 1, 1893, balance unexpended	5,085.93
July 1, 1893, outstanding liabilities	.96
July 1, 1893, balance available	5,084.97

(See Appendix V 8.)

9. *Yazoo River, Mississippi.*—Work in this river was begun in 1873, and the project contemplated removing wrecks, snags, logs, leaning timber, etc., obstructing navigation the entire length of the river. New obstructions, caused by floods, sliding and caving banks, etc., are brought into the river every year, and no estimates for permanent improvement are given on this account.

The total amount expended to June 30, 1892, was $211,919.43, part of which was applied to constructing the snag boat *Meigs*, the purchase of a pumping dredge, and to the survey of the mouth and lower river. Prior to improvement the river was obstructed by a large number of wrecks, snags, and leaning timber that limited the period of navigation. Nine of the steamboats sunk during the war of the rebellion were removed by contract in 1873–'74, and snag boats have operated since whenever funds were available, benefiting low-water navigation greatly, and keeping the river in navigable condition from head to mouth the year round.

In the past fiscal year the snag boat *Meigs* was employed during the low-water season in removing obstructions from the channel, and did effective work, putting the stream in good navigable condition, but as new snags and tree slides are brought in by every high stage of water, operations will have to be continued for many years.

July 1, 1892, balance unexpended	$3,080.57
Amount appropriated by act approved July 13, 1892	20,000.00
	23,080.57
June 30, 1893, amount expended during fiscal year	11,639.15
July 1, 1893, balance unexpended	11,441.42
July 1, 1893, outstanding liabilities	19.82
July 1, 1893, balance available	11,421.60
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

(See Appendix V 9.)

10. Mouth of Yazoo River, Mississippi.—The shifting bar at mouth of Yazoo River is the most serious obstruction to commerce, and boats that could navigate the principal streams of the Yazoo Valley system (about 800 miles) without hindrance are prevented at low stages from entering or leaving without lightering, and frequently navigation across the bar is closed altogether. The river and harbor act of 1890 directed a survey to determine in what manner the mouth could be improved to permit free passage of vessels at all seasons of the year, and to include an investigation of the feasibility and advantage of making a new outlet for the river with an estimate of cost.

The report on this survey was transmitted to Congress and printed as House Ex. Doc. No. 125, Fifty-second Congress, first session (also in Appendix V 10, Annual Report, Chief of Engineers, 1892). The improvement therein proposed contemplates the formation of a new outlet from the former mouth of Yazoo on Old River, through the deep water in Old River, across the low lands between Long and Barnett lakes to Lake Centennial, around the head of De Soto Island, along the front of Vicksburg, entering Mississippi River on the channel side at Kleinston. The cost of the work required was estimated at $1,500,000.

The river and harbor act of 1892 appropriated $75,000 for commencing work under the foregoing project, to be applied to obtaining and clearing and grubbing the right of way for the proposed land cut, and to include necessary borings and gaugings. During the year survey and location of trial and final lines for the canal were made. All the field work has been plotted and the maps will be finished soon. The precise levels were completed and were being checked at the close of the year, and most of the discharge observations had been computed. High stages of water prevented making borings along the line of canal, but it is intended to make them as soon as the river falls sufficiently,

after which the right of way will be purchased and cleared and grubbed preparatory to excavation.

Amount appropriated by act approved July 13, 1892	$75,000.00
June 30, 1893, amount expended during fiscal year	9,419.15
July 1, 1893, balance unexpended	65,580.85
July 1, 1893, outstanding liabilities	3.27
July 1, 1893, balance available	65,577.58
Amount (estimated) required for completion of existing project	1,125,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,125,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867, and of sundry civil act of March 3, 1893.

(See Appendix V 10.)

11. Tchula Lake, Mississippi.—This work commenced in 1881, and the project contemplated removing snags, logs, leaning timber, etc., obstructing navigation, to permit light-draft boats to enter the lake earlier in the season.

The amount expended to June 30, 1892, was $14,970.59, resulting in clearing the greater portion of the leaning timber from the banks and in the removal of the main obstructions from the channel, giving greater ease and safety to the passage of steamboats through the lake; but the period of navigation was not prolonged, owing to the enlargement of the bars in the lake.

No work was done during the past fiscal year, but it is intended to resume the removal of obstructions to navigation as soon as the water falls to a low stage.

By the expenditure of $6,000 in one low-water season the obstructions can be removed so thoroughly as not to need further attention for years, and inexpensive brush or pile dams can be built at the bars to extend the period of navigation.

July 1, 1892, balance unexpended	$29.41
Amount appropriated by act approved July 13, 1892	3,000.00
	3,029.41
June 30, 1893, amount expended during fiscal year	83.23
July 1, 1893, balance unexpended	2,946.18
July 1, 1893, outstanding liabilities	9.00
July 1, 1893, balance available	2,937.18
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix V 11.)

12. Tallahatchee River, Mississippi.—This improvement was begun in 1879, and contemplated removing snags, sunken logs, and leaning timber obstructing low-water navigation below the mouth of Coldwater River about 100 miles, and the removal of a wreck in the channel near the mouth. The estimated cost of the work was $40,000 if completed in two seasons.

The amount expended to June 30, 1892, was $37,481.48, of which $10,000 was required by law to be expended above the mouth of Coldwater (a part of the river in which there has been no navigation since the war, and which was not included in the project). The work done resulted in great benefit to navigation below Sharkey Landing, a distance of about 65 miles, enabling steamboats to run to that place the

year round, while before the improvement commenced there was navigation for only about six months of the year. Little work was done above Sharkey, because the funds were not sufficient and because until 1890 the steamboat interest reported that boats would not run above that landing, except to make occasional trips at high stages, when navigation was as good and about as safe as in the lower river. No benefit was derived from the work done in 1880, 1881, and 1882 above the mouth of Coldwater to Batesville, required by the appropriation acts, for the reason that there has been no trade in that part of the stream.

In the past fiscal year the snag boat *Meigs* was employed for seven weeks in removing obstructions to navigation. The river below Sharkey Landing was put in good navigable condition, after which operations were carried up to mouth of Coldwater River with considerable benefit to navigation of that stretch of river.

The original estimates contemplated completing this work in two consecutive seasons at a cost of $40,000, but the total amount appropriated in fourteen years is only $42,500, of which the law required $10,000 to be expended in a part of the river not included in the project. New obstructions are added every year by sliding and caving banks, and the shifting and scouring of the channel exposes others or lodges them upon the bars. The sum of $10,000 can be expended profitably in one season of low water, and result in permanent benefit to navigation.

July 1, 1892, balance unexpended	$18.52
Amount appropriated by act approved July 13, 1892	5,000.00
	5,018.52
June 30, 1893, amount expended during fiscal year	4,071.08
July 1, 1893, balance unexpended	947.44
July 1, 1893, outstanding liabilities	17.50
July 1, 1893, balance available	929.94
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

(See Appendix V 12.)

13. Steele and Washington bayous, Mississippi.—The improvement of Steele Bayou commenced under the act of 1884. Washington Bayou, about 7 miles long, which connects Steele Bayou with Lake Washington, was added by act of 1886. The project contemplates removing snags, stumps, drift, and leaning timber to improve high-water navigation.

The amount expended to June 30, 1892, was $9,987.33, with which Steele Bayou was worked over twice from its source in Swan Lake to its mouth, and the obstructions in Washington Bayou were removed in 1886. This work resulted in greater ease and safety to steamboat navigation at high stages, but was by no means thorough, on account of the small amounts appropriated.

No work was done in the past fiscal year.

Steamboat navigation in this stream was not commenced until 1879, and since the construction of a railroad through the country in 1884 it has fallen off until for several years the trade has amounted to little or nothing. The stream is navigable only when the Mississippi is high enough to fill the lower portion with backwater, and owing to the uncertainty of steamboat transportation there is no probability that the trade will revive. In view of the foregoing, no recommendation is made for continuing the work.

July 1, 1892, balance unexpended	$12.67
Amount appropriated by act approved July 13, 1892	2,500.00
	2,512.67
June 30, 1893, amount expended during fiscal year	69.10
July 1, 1893, balance unexpended	2,443.57
July 1, 1893, outstanding liabilities	.31
July 1, 1893, balance available	2,443.26

(See Appendix V 13.)

14. Big Sunflower River, Mississippi.—Work in this river commenced in 1879. The project contemplated building wing dams to scour a channel about 40 inches deep at the bars, and the removal of snags, sunken logs, and leaning timber obstructing navigation.

The amount expended to June 30, 1892, was $56,935.11. Operations during the fourteen years extended over the navigable part of the river from Clarksdale to the mouth, though little has been done above Faisonia since 1882, for the reason that it would have resulted in no benefit to commerce or navigation to clear the upper river and allow the lower portion to remain obstructed, the amounts appropriated at irregular intervals having been too small to permit work over the whole river. To obtain the greatest benefit with the means available, it has been the endeavor to keep the lower river open the year round and to extend navigation higher as the work progresses. Steamboat men report that before the improvement commenced the river was navigable for very light boats about six months of the year; now it is navigable to Woodburn the year round, but difficult and dangerous at low stages on account of shoals, snags, and sunken logs. Larger boats are used and make the round trip from Vicksburg (about 180 miles and return) in five days, while before the improvement it was unusual for a boat to make the trip under eight days. Freight rates are reported to be 50 per cent less. The lands along the river are being cleared and settled rapidly of late years, which is attributed in part to the improved navigation.

In the past fiscal year the snag boat *Meigs* worked fifty-one days between the mouth and Faisonia and removed a large number of the obstructions to navigation.

As new obstructions are added from time to time, it is impracticable to give a definite estimate for permanent improvement, but an appropriation of $20,000 can be expended profitably in one season of low water for improving and extending navigation of this stream, and will result in greater benefit and work of a more lasting character than can be obtained with a larger sum in small allotments at intermittent periods.

July 1, 1892, balance unexpended	$64.89
Amount appropriated by act approved July 13, 1892	5,000.00
	5,064.89
June 30, 1893, amount expended during fiscal year	4,367.80
July 1, 1893, balance unexpended	697.09
July 1, 1893, outstanding liabilities	24.05
July 1, 1893, balance available	673.04
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix V 14.)

15. Big Hatchee River, Tennessee.—This work commenced in 1880. The project contemplated removing logs, snags, leaning timber, etc., to render the river navigable for light-draft boats throughout the year from the mouth to Bolivar, Tenn., about 240 miles.

Before work commenced navigation was virtually suspended by the obstructions. The amount expended to June 30, 1892, was $29,821.52, rendering the stream navigable for light boats from seven to nine months of the year.

No work was done during the fiscal year ending June 30, 1893, as there was no boat that could be spared for the purpose, and the amount of funds available was too small to purchase or hire a suitable vessel.

The small amount of commerce to be benefited is not commensurate with the cost of continuing this improvement, and it is not believed that an additional appropriation can be expended profitably.

July 1, 1892, balance unexpended	$2,178.48
Amount appropriated by act approved July 13, 1892	3,500.00
	5,678.48
July 1, 1893, outstanding liabilities	2.56
July 1, 1893, balance available	5,675.92

(See Appendix V 15.)

16. Forked Deer River, Tennessee.—Work in South Fork of this river commenced in 1883. The act of 1888 added North Fork and main river under the general head of improving Forked Deer River. The project contemplated removing snags, logs, leaning timber, etc., obstructing navigation in South Fork below Jackson, North Fork below Dyersburg, and the main stream from the forks to the Mississippi.

The amounts expended to June 30, 1892, were $12,500 for South Fork and $9,496.25 for North Fork and the main river. With these expenditures the two forks were put in fairly good navigable condition, and the removal of obstructions from the main stream enabled small boats to navigate it with greater ease and safety for a period of about eight months during the fiscal year 1892. Navigation of South Fork is carried on by flatboats, and before the improvement commenced about one boat in three was lost on account of the obstructions; now they make the trip in comparative safety and at less cost. The work in North Fork enabled boats to run at a stage 3 feet lower than formerly.

The act of 1892 provided $3,000 for "completing improvement" of North Fork and the main river, but no work was done in the past fiscal year, as no boat could be spared for the purpose, and the amount of funds available was not sufficient to permit the purchase or hire of a suitable vessel. As soon as one of the snagboats of the district can be spared the work will be completed.

In view of the limited commerce to be benefited, it is not believed that any further appropriation can be expended profitably.

July 1, 1892, balance unexpended	$3.75
Amount appropriated by act approved July 13, 1892	3,000.00
	3,003.75
June 30, 1893, amount expended during fiscal year	3.75
July 1, 1893, balance unexpended	3,000.00
July 1, 1893, outstanding liabilities	1.20
July 1, 1893, balance available	2,998.80

(See Appendix V 16.)

17. Water gauges on Mississippi River and its principal tributaries.—These gauges were designed to secure information from continuous

records, with a view to protecting alluvial lands against overflow, improving navigation, and giving correct reports of the stages of water, for the benefit of river men and planters, and their establishment and the maintenance of daily observations was enjoined upon the Secretary of War by joint resolution of Congress, approved February 21, 1871. (Statutes at Large, Vol. 16, page 598.)

The amount expended to June 30, 1892, was $92,205.73. Nineteen gauges were established originally, and under the portion of the joint resolution of 1871 authorizing gauges "at such other places as the Secretary of War may deem advisable," the following have been added, viz: At Nashville, Tenn., Cumberland River, in 1873; Shreveport, La., Garland, Ark., and Fulton, Ark., Red River, in 1890; and Donaldsonville, La., Mississippi River, in 1890. The gauge at Rock Island, Ill., was abandoned in 1879, and the one at Fort Leavenworth, Kans., in 1886, but a record at the latter place has been maintained by the Missouri River Commission.

There are now 22 gauges maintained under this work, and, in addition to the extensions mentioned above, the service has been improved very materially of late years. In 1881 bulletins were erected at the stations on the Mississippi for the purpose of giving passing steamboats the stage of water and indicating whether the river was rising, stationary, or falling, and in 1890 these were replaced by larger bulletins, and the old ones repaired and used in extending the service to the tributaries. Since February 1, 1887, the gauges have been read and bulletins posted twice a day to secure greater uniformity and accuracy; formerly they were read only once a day. Records of the readings have been published by the Mississippi River Commission to the end of the calendar year 1892.

The value of the records requires that they shall be accurate and continuous, and to provide for this, and enlarge and perfect the service, a permanent indefinite appropriation was made by section 6 of river and harbor act of August 11, 1888.

It is recommended that section 6 of the act of August 11, 1888, be amended to grant a permanent appropriation of such amount as may be necessary to do the work, not to exceed in the aggregate for each fiscal year the sum of $12,000. That amount will provide for maintenance and perfection of the system, a judicious extension of the service by embracing other gauges now on the Lower Mississippi and principal tributaries, and establishing new ones at such places as may be found advisable; thus putting the gauges under one management and system of inspection with economy and advantage to the entire service; and permitting gradual level connections with a common reference plane, to give greatest value to the records.

As the work at St. Paul, Minn., consists of discharge measurements during operation of the reservoirs at headwaters of the Mississippi, and as it is a different class of work without connection with the gauges on the lower river and tributaries, it is recommended that it be provided for by separate appropriation.

July 1, 1892, balance unexpended	$27.98
Amount allotted for fiscal year ending June 30, 1893	5,500.00
	5,527.98
June 30, 1893, amount expended during fiscal year	5,498.17
July 1, 1893, balance unexpended	29.81
July 1, 1893, outstanding liabilities	28.19
July 1, 1893, balance available	1.62

(See Appendix V 17.)

18. Survey of Cypress Bayou and the lakes between Jefferson, Tex., and Shreveport, La.—This survey was ordered by river and harbor act of September 19, 1890, to ascertain whether the navigation of the bayou and lakes can be materially and permanently improved by the construction of locks and dams, and, if found practicable, the probable cost thereof.

The original estimates for the survey amounted to $12,000, but only $10,000 was appropriated, and owing to this insufficient amount and delays by high water the work was not completed. A report was submitted by Capt. Willard, the local engineer in charge, February 6, 1892, stating the progress made in the conduct of the survey, and the necessity for further consideration and investigation of the subject. The river and harbor act of July 13, 1892, appropriated $2,000 for completing the survey, which has been done during the past fiscal year.

The plan for improving the lakes and bayous between Jefferson, Tex., and Shreveport, La., contemplates the construction of a dam, with waste weir across Sodo Lake, with entrance from Red River through Cottonwood Bayou by a lock with double gates, at an estimated cost of $375,000. But as the plan of improving Red River is carried out and the outlets closed along its right bank, the water supply of Cypress Bayou and the lakes will be limited to the natural drainage of their basin, with what might be let in from Red River through Cottonwood Bayou, or through sluices near by.

In view of the limited amount of commerce to be benefited, the cost of operating and maintenance, and the fact that the probable life of the improvement can not be estimated, it is doubtful whether the work should be undertaken.

July 1, 1892, balance unexpended	$6.01
Amount appropriated by act approved July 13, 1892	2,000.00
	2,006.01
June 30, 1893, amount expended during fiscal year	1,930.34
July 1, 1893, balance unexpended	75.67
July 1, 1893, outstanding liabilities	16.72
July 1, 1893, balance available	58.95

(See Appendix V 18.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. J. H. Willard, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers.

1. Sulphur River from its mouth to Sulphur Station, Tex.—Capt. Willard submitted report of examination under date of May 16, 1893. He considers the river worthy of improvement by removing snags and other obstructions, with perhaps a small amount of dredging. It is the opinion of the division engineer, concurred in by this office, that this portion of the river is worthy of improvement to a small extent, by snagging, by the General Government. No survey is necessary for preparation of project and estimate of cost of improvement. (See Appendix V 19.)

2. Little River, Arkansas.—Capt. Willard submitted report of examination under date of May 17, 1893. It is his opinion and that of

the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States. (See Appendix V 20.)

3. Ouachita River above Camden, Ark.—Capt. Willard submitted report of examination under date of May 17, 1893. It is his opinion and that of the division engineer, concurred in by this office, that this portion of the river is not worthy of improvement by the General Government. (See Appendix V 21.)

4. Cassity Bayou, Mississippi.—Capt. Willard submitted report of examination under date of May 17, 1893. He considers the bayou worthy of improvement by the United States as soon as the chartered rights of the Cassity Lock and Dam Company over this stream are revoked. It is the opinion of the division engineer, concurred in by this office, that the bayou is not worthy of improvement by the General Government. (See Appendix V 22.)

5. Coldwater River, Mississippi.—Capt. Willard submitted report of examination under date of May 17, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States. (See Appendix V 23.)

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

This district was in the charge of Capt. H. S. Taber, Corps of Engineers; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Removing obstructions in Arkansas River.—Prior to the first improvements in 1833, shifting sand bars, numerous drift piles, and dangerous snags constituted the obstacles to navigation in the lower reaches, and gravel and rock shoals, with a few snags and many overhanging trees, constituted those of the upper. Except for a few special reaches, like the Fort Smith and Pine Bluff, the general plan of improvement has consisted in snagging operations, including the cutting of overhanging trees, in building wing dams to improve the shoals, and in surveys looking toward plans for its permanent improvement.

The appropriations to June 30, 1893, amount to $505,251.37. Of this sum there had been expended to June 30, 1892, $410,446.10.

During the fiscal year ending June 30, 1893, $22,073.54 was expended in snagging operations at or near low water, and in construction of snag boat.

July 1, 1892, balance unexpended	$2,028.43
Received on account of sale of U. S. towboat *C. B. Reese*	20,000.00
Amount appropriated by act approved July 13, 1892	20,000.00
	42,028.43
June 30, 1893, amount expended during fiscal year	22,073.54
July 1, 1893, balance unexpended	19,954.89
July 1, 1893, outstanding liabilities	4,322.58
July 1, 1893, balance available	15,632.31
Amount (estimated) required for work annually	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	70,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts or 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix W 1.)

2. Arkansas River.—Work during the past season has been carried on under four different acts of Congress.

The appropriation made by act of August 5, 1886, except a small

sum out of $10,000 allotted for work at Dardanelle, was expended prior to June 30, 1890; at Dardanelle the $10,000 was to be expended in erecting a permeable dike above and opposite the town in such a position as to remove the sand bar in front of the wharves.

By act of August 11, 1888, the sum of $150,000 was appropriated for the improvement of this river, under plan providing for the formation of a channel at least 200 feet wide and 6 feet deep at low water from Little Rock to the Mississippi River, and the formation of a channel 2 feet deep at low water and from 200 to 300 feet wide from Fort Gibson to Arkansas City, as contemplated in the report of the Chief of Engineers for the year ending June 30, 1885, and in House Ex. Doc. No. 90, Forty-ninth Congress, first session, and authorized in the act approved August 5, 1886.

By act approved September 19, 1890, the sum of $180,000 was appropriated. By act approved July 13, 1892, $250,000 was appropriated. The approved projects for the expenditure of this amount may be summarized as follows:

At Van Buren, $4,000 to be expended in erecting a permeable dike at a suitable point a little above the town and upon the opposite side of the river, to contract the channel and prevent it from leaving the city wharves. From Fort Gibson, Ind. T., to the mouth of the river the balance to be expended in the erection of permeable dikes and in rock excavation at worst places, so far as the amount of the appropriation will permit, looking toward the permanent improvement of the river, to give a channel at least 6 feet deep and 200 feet wide from Little Rock to the mouth of the river, via White River Cut-off, as provided under the act of August 5, 1886, and an all-year-round depth of water of at least 2 feet from Little Rock, Ark., to Fort Gibson, Ind. T.

Before operations were begun at Dardanelle a bad bar had formed along the town front, cutting off all approach to either wharf at low water or at medium stage.

From Fort Gibson to the mouth of the river the river consists of alternating bars and caving banks, with crossings more or less troublesome at low water, a few of the latter operating to effectually close the river to navigation at extreme low water, even for boats drawing but 2 feet of water.

From Fort Gibson, Ind. T., to the mouth of the river $177,897.93 has been expended during the fiscal year ending June 30, 1893.

The work was carried on under three allotments, so far as the appropriation for 1892 is concerned, two-fifths of this amount being intended for the reach from the mouth of the river to Little Rock, two-fifths from Little Rock to Fort Smith, and one-fifth above Fort Smith.

The project for this last appropriation consisted practically in the solidifying of works already in existence, that were erected out of perishable materials, with new works in accordance with the general plan after these had been completed.

At Moores Rocks a channel 75 feet wide, 425 feet long, and 2 feet deep at low water was completed. Dikes 1½, 2, 2½, and 3, above Fort Smith, were converted into solid stone-capped dikes. At Van Buren the old dike was solidified, as was also the railway incline.

At Dardanelle work at solidifying the old dike and the construction of the new brush and stone dike was begun.

A large quantity of rock was quarried at Big Rock, 3 miles above Little Rock, and taken down the river for works below. Some of this rock was also used for the conversion of Dikes A, B, and C above the

Baring Cross Bridge into solid stone-capped dikes, and in the erection of two additional dikes 150 feet long and 7 feet above low water. Dikes 1, 2, 3, and 4 below the Little Rock and Fort Smith Railway Bridge were converted into solid dikes, as were also Dikes 2, 3, and 4 opposite the town of Pine Bluff, which, with the revetment of the bank between Dikes 4 and 5 completed, and that between Dikes 5 and 6 begun, with some works begun upon the A series of dikes below Pine Bluff, constitutes the sum total of the work of the season, except certain addition to the plant.

July 1, 1892, balance unexpended	$37,459.69
Amount appropriated by act approved July 13, 1892	250,000.00
	287,459.69
June 30, 1893, amount expended during fiscal year	177,897.93
July 1, 1893, balance unexpended	109,561.76
July 1, 1893, outstanding liabilities	15,176.55
July 1, 1893, balance available	94,385.21
Amount (estimated) required for completion of existing project	3,222,479.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W 2.)

3. Fourche Le Fevre River, Arkansas.—The improvement of this stream was begun in 1879, under the act approved March 3, 1879.

Prior to improvement its channel was choked with snags, logs, and drift, and heavy timber overhung its banks. Several bad shoals also impeded navigation.

Up to June 30, 1886, $21,000 had been expended in removing the greater part of the obstructions.

By act approved August 5, 1886, $5,000 was appropriated for removing rock shoals situated about 4 miles below Perryville. At the close of the fiscal year ending June 30, 1888, this sum had been expended, completing a channel about 500 yards long, 30 feet wide, and 2 feet deep at low water through this shoal.

By act approved September 19, 1890, $7,500 was appropriated. The approved project for its expenditure provides for the building and equipping of a hand-propelled snag boat at a cost not to exceed $4,000, to be operated for four months at or near extreme low water, in removing accumulated obstructions, snags, logs, drift piles, landslides, and bowlders on Piney Shoals, $450 to be expended in making a cut through May Shoal to provide for high and medium-stage navigation.

Up to June 30, 1892, $6,192.03 had been expended in building and equipping the hand-propelled snag boat *Pioneer*, and in removing 1,923 cubic yards of rock and gravel, 1,026 snags, 4 large rack heaps, several landslides, and over 25,000 overhanging trees, opening the river to high and medium-stage navigation to Perryville Landing.

July 1, 1892, balance unexpended	$1,307.97
Received on account of sale of U. S. snag boat *Pioneer*	3,500.00
	4,807.97
June 30, 1893, amount expended during fiscal year	316.47
July 1, 1893, balance unexpended	4,491.50

(See Appendix W 3.)

4. Petit Jean River, Arkansas.—Before improvement this river was obstructed by snags, logs, masses of driftwood, overhanging trees, and shoals. The original project for improvement contemplated rendering it navigable during high and medium stages of water up to Danville, Ark., by cutting the overhanging trees and cutting up the snags, logs, and drift. Three thousand five hundred dollars was expended in the execution of this project to June 30, 1888.

The appropriation made by act of August 11, 1888, was $2,500, and work was limited to the river below the bridge at Rocky Crossing. The new project provides for removing portions of the shoals known as Slaty Crossing and Robinsons Ridge, and certain timber from the low-water channel. During the fiscal year ending June 30, 1890, no work was done on account of continued high water, rendering it impossible to begin the work with any certainty of completing it. The fiscal year ending June 30, 1891, was a favorable season for this work, and many obstructions to navigation were removed. By act approved July 13, 1892, $3,500 was appropriated for completing the original project.

During the fiscal year ending June 30, 1893, navigation has suffered on account of the non-removal of the bridge at Rocky Crossing; the work will be completed during the coming fiscal year. The present appropriation meets existing demands of commerce.

Amount appropriated by act approved July 13, 1892	$3,500.00
June 30, 1893, amount expended during fiscal year	7.50
July 1, 1893, balance unexpended	3,492.50

(See Appendix W 4.)

5. White River, Arkansas.—Before improvement the channel of this river was choked with drift piles, logs, and snags in its lower portion, and from Batesville up, gravel bars, rocky shoals, channel bowlders, and overhanging trees impeded navigation. The original project consisted in snagging operations, blasting ledges and bowlders, and dam building to remove gravel bars or to close chutes. The first separate appropriation for this river was made by act approved July 5, 1884.

Provision for a survey of the river from Forsythe, Mo., to its mouth was added to the original project. At that date the river was in excellent navigable condition for boats drawing not to exceed 3 feet of water from its mouth to Newport, Ark. From Newport to Batesville there were many troublesome snags and from Batesville to Buffalo Shoals there were numerous bad shoals, rendering navigation very uncertain. From Buffalo Shoals to Forsythe, Mo., there were many fine reaches of river, but the depth of water on Buffalo Shoals and others prevented any navigation at ordinary stages of water. The present plan, based on the survey, provides for the maintenance at low water of a channel 2 feet deep between Newport and Buffalo Shoals, and a channel of not less than 5 feet deep at low water from Newport to the mouth, and also for a limited amount of snagging operations while these improvements are in progress. The result between Newport and Buffalo Shoals is to be accomplished by the erection of solid wing dams and some rock excavation. From Newport to the mouth this result is to be accomplished by the erection of low permeable spur dikes, to give the necessary depth of water on the shoals.

By act approved July 13, 1892, $75,000 was appropriated. Up to June 30, 1892, $108,708.04 had been expended, which completed the survey, plotted the notes, published the maps, effectually improved some of the most dangerous shoals between Buffalo Shoals and Newport, Ark., gave much relief to navigation by removing the most dan-

gerous snags from Batesville to the mouth of the river, and made important additions to the plant. During the fiscal year ending June 30, 1893, material was accumulated on the lower White River for the erection of dikes and the plant was increased and repaired.

Early in the next fiscal year, repairs will be begun upon the dikes in the upper river and also work upon the construction of the dikes in the lower river, if the stage of water will permit.

July 1, 1892, balance unexpended	$85.61
Amount appropriated by act approved July 13, 1892	75,000.00
	75,085.61
June 30, 1893, amount expended during fiscal year	26,284.10
July 1, 1893, balance unexpended	48,801.51
July 1, 1893, outstanding liabilities	8,921.81
July 1, 1893, balance available	39,879.70

(See Appendix W 5.)

6. *Cache River, Arkansas.*—The first appropriation made for this river became available August 11, 1888. Prior to this time the river was choked with logs, snags, and overhanging trees, and several shoals interfered with low-water navigation. The project proposes the removal of these obstructions from the town of Riverside, Ark., to the mouth of the river.

Up to June 30, 1891, $7,000 had been expended carrying out the project.

By act approved July 13, 1892, $2,000 was appropriated. This was expended carrying out the project. The boat was then sold to the appropriation "Improving Black River, Arkansas and Missouri," for $2,000.

This sum could not be expended on account of high water, but will be expended early in next fiscal year and will complete the original project. Further attention may be required as the country develops.

Received on account of sale of U. S. snag boat *Riverside*	$2,000.00
Amount appropriated by act approved July 13, 1892	2,000.00
	4,000.00
June 30, 1893, amount expended during fiscal year	2,825.58
July 1, 1893, balance unexpended	1,174.42
July 1, 1893, outstanding liabilities	273.00
July 1, 1893, balance available	901.42

(See Appendix W 6.)

7. *Little Red River, Arkansas.*—The first improvements attempted upon this river were made in 1872. Prior to this work many overhanging trees and a large number of snags interfered with navigation in the lower reaches, and many bowlders obstructed flatboat and raft navigation in the reach above the present town of Judsonia. Most of the overhanging trees and snags were removed as high as Judsonia, and the bowlders remained untouched to June 30, 1886.

By acts of August 5, 1886, and August 11, 1888, $8,400 was appropriated for removing the bowlders above Judsonia and dredging a channel through the shoals 3 miles below. After the work on the shoals had been nearly completed the dredge was sold, making $3,500 additional money available. Up to June 30, 1892, $11,191.07 had been expended removing the bowlders, building a dredge and barges, partial excavation of channel, cutting overhanging timber, removing a

few logs and snags between Judsonia and Heber, Ark., and caring for the property, and, on a special project, making the work between Judsonia and Heber more effective, after the work at Bess Shoals had been completed.

During the fiscal year ending June 30, 1893, the small balance of funds available was expended in care of property and records.

The project is completed.

July 1, 1892, balance unexpended	$300.12
June 30, 1893, amount expended during fiscal year	300.12

(See Appendix W 7.)

8. Black River, Arkansas and Missouri.—Before any improvements were made upon this river navigation was practically closed by snags, logs, and overhanging trees, the snags and logs in many places forming shoals, and in other places rock and gravel shoals interfered with navigation. The original plan for improvement contemplated the removal of the obstructions and the improvement of the shoals by wing dams. A few of the sloughs were to be closed up so as to confine the water to the main channel.

Up to June 30, 1892, $65,961.44 had been expended, the work of 1892 finally opening the river to Poplar Bluff, Mo., so that boats could reach that point during high and medium stages with reasonable facility.

During the fiscal year ending June 30, 1893, the funds appropriated by act approved July 13, 1892, were utilized in operating a hand-propelled snag boat from Poplar Bluff, Mo., to the mouth, removing the most dangerous recently accumulated obstructions.

July 1, 1892, balance unexpended	$280.96
Received on account of sale of U. S. towboat *Henry Sheldon*	4,500.00
Amount appropriated by act approved July 13, 1892	5,000.00
	9,780.96
June 30, 1893, amount expended during fiscal year	6,178.28
July 1, 1893, balance unexpended	3,602.68
July 1, 1893, outstanding liabilities	2.75
July 1, 1893, balance available	3,599.93
Amount (estimated) required for work annually	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	42,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W 8.)

9. Black River, Missouri.—The first improvements attempted upon this reach of river were made in the years of 1881 and 1882. Prior to this work its channel was choked with snags and logs, and obstructed by overhanging trees, and in many places shoals interfered with its navigation at low water by any but very light-draft boats. The original plan for improvement contemplated the removal of the obstructions and the improvement of the shoals, the latter by wing dams. A few sloughs were to be closed up so as to confine the water to the main channel. Up to June 30, 1892, $19,904.41 had been expended in removing overhanging trees, trees that had fallen across the channel, dangerous snags and piles of drift, all of these items in formidable numbers, giving great relief to navigation.

July 1, 1892, balance unexpended	$95.59
June 30, 1893, amount expended during fiscal year	95.59

(See Appendix W 9.)

10. St. Francis River, Arkansas.—Appropriations have been made for this river in connection with those for the White River. The first appropriation was made March 2, 1833, prior to which this river was choked with drift, logs, snags, and its waters spread out through a great variety of sloughs, while overhanging trees added to the difficulty of navigation. The originally adopted project was principally for snagging operations, and attempts have been made to close up some of the many sloughs. On July 5, 1884, the first separate appropriation was made. From that time to June 30, 1892, $27,956.86 had been expended in carrying out the approved project.

By act approved July 13, 1892, $8,000 was appropriated.

During the fiscal year ending June 30, 1893, $3,795.61 was expended in the continuance of the project, in the execution of much-needed work between Madison, Ark., and the mouth of the river.

High water prevented the economical expenditure of the balance.

July 1, 2892, balance unexpended	$13.14
Amount appropriated by act approved July 13, 1892	8,000.00
	8,043.14
June 30, 1893, amount expended during fiscal year	3,795.61
July 1, 1893, balance unexpended	4,247.53
July 1, 1893, outstanding liabilities	135.20
July 1, 1893, balance available	4,112.33
Amount (estimated) required for work annually	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	28,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W 10.)

11. St. Francis River, Missouri.—The first appropriation made for this reach of river was that of act of August 11, 1888, $5,000. Prior to the work done with this sum, logs, snags, overhanging trees, and several shoals interfered with low-water navigation.

The estimate, $7,300, proposed the removal of the shoals about 12 miles below Greenville and the removal of snags and other obstructions. The amount appropriated by act of August 11, 1888, was inadequate.

Up to June 30, 1892, $12,329.77 had been expended, cutting a narrow channel through the Big Drift and carrying out other provisions of the original project, combined with those of the project under act approved September 19, 1890, which, added to the original project, provides for a hand-propelled snag boat for use between the Sunk Lands and Greenville, Mo., including the building of the boat. This also removed a formidable array of obstructions from St. Francis, Ark., to the Big Drift.

During the fiscal year ending June 30, 1893, the boat was sold to the appropriation "Removing obstructions in Arkansas River, Arkansas and Kansas," and the money thus secured expended in widening the channel through the Big Drift and in removing a few obstructions between there and the town of St. Francis, Ark.

July 1, 1892, balance unexpended	$3,170.23
Received on account of sale of U. S. snag boat *Missouri*	3,000.00
	6,170.23
June 30, 1893, amount expended during fiscal year	3,186.24
July 1, 1893, balance unexpended	2,983.99
July 1, 1893, outstanding liabilities	48.69
July 1, 1893, balance available	2,935.30

(See Appendix W 11.)

12. Little River, Missouri.—Before improvement this river was obstructed by snags, logs, masses of driftwood, and shoals, and was divided into two chutes. The project for improvement contemplates prolonging medium-stage navigation by closing one of the chutes and removing the obstructions enumerated from the other.

Appropriations aggregating $8,000 were made for the improvement of this stream by acts of August 11, 1888, and September 19, 1890. This sum, with the exception of a small balance, was expended prior to June 30, 1892, in the construction of a dam 300 feet long across the right chute and the removal of the obstructions in the main channel.

July 1, 1892, balance unexpended	$20.52
June 30, 1893, amount expended during fiscal year	20.52

(See Appendix W 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—On July 20, 1892, the wreck of the steamer *John Matthews* in the channel of the Arkansas River at Van Buren, Ark., which lay half buried in water against the piers of the bridge of the St. Louis and San Francisco Railway Company, was reported to the Secretary of War by that company as an obstruction to navigation and a menace to their property. This wreck was removed at a cost of $401.30. (See Appendix W 13.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. H. S. Taber, Corps of Engineers, and reports thereon submitted through the division engineer, Col. C. B. Comstock, Corps of Engineers.

1. Saline River, Arkansas.—Capt. Taber submitted report of examination under date of January 24, 1893. He considers the river worthy of improvement to the extent of removing snags and other obstructions. It is, however, the opinion of the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 236, Fifty-second Congress, second session. (See also Appendix W 14.)

2. Fourche Le Fevre River, Arkansas.—Capt. Taber submitted report of examination under date of January 21, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of additional improvement by the General Government at the present time. The report was transmitted to Congress and printed as House Ex. Doc. No. 226, Fifty-second Congress, second session. (See also Appendix W 15.)

3. Current River, Arkansas.—Capt. Taber submitted report of examination under date of January 17, 1893. He considers the river worthy of improvement; and it is the opinion of the division engineer, concurred in by this office, that Current River, Arkansas, is "worthy of some small improvement by snagging." No survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 227, Fifty-second Congress, second session. (See also Appendix W 16.)

EXAMINATIONS OF MEMPHIS HARBOR AND WOLF RIVER, TENNESSEE, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following-named localities, required by act of July 13, 1892, were made by the local engineer, Capt. S. W. Roessler, Corps of Engineers, and reports of the results submitted, with the views thereon of Col. C. B. Comstock, Corps of Engineers, the division engineer of the southwest division.

1. Harbor at Memphis, Tenn., including removal of bar forming opposite the upper part of the city, and bank protection along the city front.—Capt. Roessler submitted report of examination under date of April 8, 1893 It is his opinion and that of the division engineer, concurred in by this office, that the removal of the bar opposite the upper part of the city is not worthy of being undertaken by the United States; and that the protection of the bank along the city front, although not at the present time immediately urgent, is worthy of being done by the General Government. The cost of the necessary survey for preparation of project and estimates of cost of improvement can be provided from funds under the control of the Mississippi River Commission. (See Appendix X 1.)

2. Wolf River, Tennessee.—Capt. Roessler submitted report of examination under date of April 11, 1893. He considers that no dredging in the river will be required this year, but that, if it should be required in the future, the work is worthy of being done by the United States; and he recommends that a survey be made, the cost of which is estimated at $100. It is the opinion of the division engineer, concurred in by this office, that the mouth of Wolf River is worthy of improvement by a moderate amount of dredging. (See Appendix X 2.)

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS, OF GASCONADE AND OSAGE RIVERS, MISSOURI, AND OF KASKASKIA RIVER, ILLINOIS.

This district was in the charge of Maj. A. M. Miller, Corps of Engineers, to March 4, 1893, and of Maj. Charles J. Allen, Corps of Engineers, since that date; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Removing snags and wrecks from Mississippi River.—Before this work was inaugurated the navigation of the river was very much interfered with by numerous snags, logs, etc., which had lodged in the channel, and to which a new accession was brought down on each rise of the river, thus constantly adding new and unknown obstructions to those already there. A large number of wrecks, dangerous to navigation, also occupied the channel.

For the removal of these obstructions appropriations were made as early as 1824, and the project adopted consisted in building boats suitable for removing the snags, etc., and operating them whenever the stage of water was favorable for the work and the funds were available.

The total amount expended for this purpose can not be definitely given, as previous to the appropriation made by act of March 3, 1879, a general amount was appropriated to be applied to several streams as their needs required. From March 3, 1879, when the first specific appropriation was made, up to June 30, 1892, $834,260.77 had been ex-

pended for this purpose. The navigation of the river has been very materially improved by this method and the danger to boats lessened.

During the fiscal year ending June 30, 1893, the sum of $96,497.23 was expended upon this improvement. Two snag boats were employed in removing obstructions to navigation between the mouth of the Missouri River and New Orleans, La. The boats worked a total of fifteen months, removing 2,946 snags, cutting down 8,214 trees, removing 16 drift piles, and traveling a total of 17,982 miles.

The work accomplished by the snag boats has been of great benefit to navigation and commerce. Formerly the wrecking of steamboats from running against snags was of frequent occurrence, but since the snag boats have been regularly at work such wrecks are seldom heard of.

The boats were thoroughly overhauled during the past spring, and necessary repairs were made to them together with some small renewals of machinery.

An annual appropriation for carrying on this work was made by act of August 11, 1888.

The amount expended during fiscal year ending June 30, 1893, was $96,497.23.

(See Appendix Y 1.)

2. Mississippi River between Ohio and Missouri rivers.—The original condition of the navigable channel of this portion of the Mississippi River, before the work of improvement was begun, was such that the natural depth at low water was in many places from 3½ to 4 feet. The channels were divided by islands which formed sloughs and secondary channels, thus wasting water available for navigation.

The project adopted for improvement consisted in closing sloughs and secondary channels, and also in construction of works of contraction in order to concentrate the flow into a single channel about 2,500 feet wide, the object being to thereby obtain a depth of 8 feet in the channel between St. Louis and Cairo, and 6 feet between St. Louis and the mouth of the Missouri, at standard low water which corresponds to a reading of 4 feet on the St. Louis gauge. Also in revetment of banks when necessary.

The amount expended up to the close of the fiscal year ending June 30, 1892, was $4,080,803.15, and the result of the work was that but little difficulty to navigation was experienced throughout the improved portion, and then only at extreme low water.

For stages of water above 4 feet on the St. Louis gauge there was generally a depth of at least 6 feet in the channel.

The amount expended during the fiscal year ending June 30, 1893, was $283,767.17, and was applied to repairing plant and carrying on works at the following-named localities:

Twin Hollows.—One hurdle 362 feet long was built and another partly built.

Pulltight.—The work consisted in repairing Hurdle No. 4, in extending it 630 feet, and in driving 400 linear feet of drift clumps above the old part of this hurdle to protect it; also in repairing Hurdle No. 5, and restoring it to its original length. Hurdle No. 1 was extended. Hurdle No. 2 was repaired and extended 1,200 feet, and 1,500 linear feet of new work (Hurdle 6) built.

Chesley Island.—The bank protection was repaired.

Rush Tower Reach.—Operations consisted in the construction of 6,800 linear feet of protection of the Illinois shore above Durfees Land-

ing. About 1,225 feet of bank along Lowrys Field was partially revetted. Three hundred linear feet of hurdle at Michaels was repaired. Construction of hurdles was begun at Fish Bend and 1,815 linear feet nearly completed.

Fort Chartres Reach.—The work of the year consisted in protection of the bank, below medium stage of water, from Sycamore Landing downstream for a distance of 5,500 feet, and the building of Hurdles 2 and 3, having a total length of 3,525 feet, on the west side of Bruce Island. These hurdles were considerably damaged upon the breaking up of the ice in the latter part of February, and subsequently by heavy fields of driftwood. As soon as possible, in March following the breakup, the work of repairing these hurdles was undertaken, and was continued until about the middle of May when, on account of the high stage of water, work on the hurdles was temporarily suspended.

The total amount expended during the fiscal year ending June 30, 1893, was $283,767.17.

The original estimated cost of the work, as revised in 1883, is $16,397,500, of which $5,388,333.33 from appropriations to date has been available for the work.

In general the works constructed have benefited the navigation.

July 1, 1892, balance unexpended		$124,196.85
Amount appropriated by act approved July 13, 1892		525,000.00
Amount appropriated by sundry civil act approved March 3, 1893		658,333.33
		1,307,530.18
June 30, 1893, amount expended during fiscal year		283,767.17
July 1, 1893, balance unexpended		1,023,763.01
July 1, 1893, outstanding liabilities	$30,565.40	
July 1, 1893, amount covered by uncompleted contracts	149,295.24	
		179,860.64
July 1, 1893, balance available		843,902.37
Amount (estimated) required for completion of existing project		11,009,166.67
Amount that can be profitably expended in fiscal year ending June 30, 1895		758,333.33
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix Y 2.)

3. Harbor at St. Louis, Mo.—St. Louis Harbor is about 18 miles long and divided into two nearly equal parts by the Eads Bridge. The upper part, included between the bridge and the northern limits of the city, is about 10 miles in length. Three miles above the Eads Bridge is the Merchants' Bridge. The lower part of the harbor, included between Eads Bridge and River Des Peres, is 8 miles long. The channel in this part of the harbor has sufficient depth and accessible landings at all points. Good depth exists above the Merchants' Bridge.

Congress, by act approved September 19, 1890, appropriated $182,000 for this harbor.

The navigable reach between the Eads Bridge and Merchants' Bridge was at that time obstructed by a number of middle bars. The project adopted for improvement of the harbor under the appropriation of 1890 consisted in a contraction of the waterway, between those bridges, to a width of about 2,000 feet in order to concentrate the flow upon the bars and thus cause scour to the depth desired. The contraction works

consisted of a series of hurdles extending out from the Illinois shore, the object of the hurdles being to collect deposits of material brought down during floods and thus build up a new bank to the line desired.

This work, which was accomplished by the close of the fiscal year ending June 30, 1892, caused extensive deposits of sediment along the line of hurdles and has resulted in considerable increase in channel depth with corresponding benefit to navigation.

Amount expended upon the work to July 1, 1892, $150,530.21.

No expenditure was made during the past fiscal year.

The full amount of the estimate for improvement of this part of the harbor has been appropriated. With the balance remaining it is proposed to repair damage that may occur to the hurdles from ice and drift and to extend them wherever found necessary to do so.

July 1, 1892, balance unexpended	$31,469.79
July 1, 1893, balance unexpended	31,469.79
July 1, 1893, outstanding liabilities	230.04
July 1, 1893, balance available	31,239.75

(See Appendix Y 3.)

4. Gasconade River, Missouri.—The navigation of this stream, before its improvement was undertaken by the Government, was seriously obstructed by snags, logs, and leaning timber, and at times almost suspended on account of numerous shoal crossings. Snags are liable to be found after every flood, which also carries more or less drift. The latter is apt to be deposited at the shoals or at other points, causing trouble to rafts and steamers.

Improvement by the Government began in 1880. The project adopted contemplated the removal of snags and logs from the channels, and of leaning timber from the banks of the river when necessary, and construction of wing dams and training walls to concentrate the flow of water upon the shoal crossing.

The amount expended to July 1, 1892, was $44,689.51, which resulted in placing the river from its mouth to Arlington, a distance of 138 miles, in good navigable condition; but the high water of that year carried many snags into the river that afterward had to be removed.

The work during the fiscal year ending June 30, 1893, resulted in further facilitating the navigation.

July 1, 1892, balance unexpended	$1,810.49
Amount appropriated by act approved July 13, 1892	4,000.00
	5,810.49
June 30, 1893, amount expended during fiscal year	2,949.89
July 1, 1893, balance unexpended	2,860.60
July 1, 1893, outstanding liabilities	353.25
July 1, 1893, balance available	2,507.35
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submited in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

(See Appendix Y 4.)

5. Osage River, Missouri.—The project for improvement of this stream, adopted in 1871, has consisted in removal of obstructions to navigation, as snags and leaning timber, and in deepening channels over shoals by means of dredging and construction of cross and wing dams, to concentrate the flow of water over shoal places. The first efforts were ex-

pended in an attempt to deepen the water over the shoals by dredging. After this the method consisted in construction of wing dams and training walls, to regulate the width of waterway for the low-water discharge of the river. Snags and other obstructions found in the channel were also removed, and leaning timber was cut from the banks. The construction of a lock and dam near the mouth of the river was authorized by the river and harbor act of September 19, 1890.

The amount expended to June 30, 1892, was $211,701.72. It resulted in benefiting the navigation from its mouth to Osceola, Mo., a distance of about 230 miles. The lower 60 miles of the river was the most benefited.

The work during the fiscal year ending June 30, 1893, put the river in good navigable condition from its mouth to Grand River.

New obstructions may be expected from time to time with each rise and fall in the river, and will require removal.

July 1, 1892, balance unexpended	$48,298.28
Amount appropriated by act approved July 13, 1892	50,000.00
	98,298.28
June 30, 1893, amount expended during fiscal year	3,871.78
July 1, 1893, balance unexpended	94,426.50
July 1, 1893, outstanding liabilities	327.67
July 1, 1893, balance available	94,098.83
Amount (estimated) required for completion of existing project	110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	*65,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1883.

(See Appendix Y 5.)

6. *Kaskaskia River, Illinois*—The original condition of this river was such that navigation at low water was almost if not entirely suspended by reason of snags, shoals, and bars, and depended to a great extent on the state of water in the Mississippi River as to its duration. The least depth found, when the St. Louis gauge read 6.5 feet, was 9 inches, over what is called the "Nine Mile Shoal," 6 miles above its mouth, which virtually "blocked" the river at low water. At high water navigation was possible as far up as New Athens.

The first appropriation for improving the river was in 1890, and the project adopted for its improvement consisted in excavating a channel through the shoals of such depth as would insure a low-water navigation of 36 inches, and in the removal of snags, and obstructions from the channel, at an estimated cost of $10,500. Congress, by act of September 19, 1890, appropriated $6,000 for improvement.

The river was not at a suitable stage to admit of performing work under that appropriation until the fall of 1891. The amount expended since the work to June 30, 1892, was $5,760.48, resulting in a channel 40 feet wide and 36 inches deep through Nine Mile Shoal and a channel 60 feet wide and 34 inches deep through Evansville Shoal and the removal of a number of snags, to the benefit of navigation. A further appropriation of $4,500 was made by the act of July 13, 1892.

The work of the year consisted in removal of snags and other obstructions, thus further improving the navigation. The result of the work done is that steamboats are enabled to pass at lower stages and for low water seasons of [illegible] nearly was the case [illegible]

*Balance in removing obstruction

July 1, 1892, balance unexpended	$239.52
Amount appropriated by act approved July 13, 1892	4,500.00
	4,739.52
June 30, 1893, amount expended during fiscal year	3,347.63
July 1, 1893, balance unexpended	1,391.89
July 1, 1893, outstanding liabilities	9.49
July 1, 1893, balance available	1,382.40

(See Appendix Y 6.)

IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS.

This district was in the charge of Maj. A. Mackenzie, Corps of Engineers, with Lieut. William V. Judson, Corps of Engineers, under his immediate orders since February 13, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Operating snag boats and dredge boats on Upper Mississippi River.—At the beginning of the fiscal year there was available under act of August 11, 1888, the sum of $25,000.

From July 14 to November 6, 1892, April 10 to May 2, and May 21 to June 30, 1893, the snag boat *General Barnard* was employed removing snags and other obstructions and assisting interests of navigation between Minneapolis and the mouth of the Missouri River.

The snag boat *J. G. Parke*, dredge *Phœnix*, and a number of barges and dump boats were employed as a dredging and wrecking plant, August 10 to September 10 and October 26 to November 5, 1892.

The total amount expended for snag-boat service on the Upper Mississippi River, between Minneapolis and the mouth of the Missouri River, to June 30, 1892, is $624,640.

By the river and harbor act of August 11, 1888, provision was made for operating snag boats and dredge boats on the Upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

The total amount of freight transported on the Upper Mississippi River during the calendar year 1892 was, approximately, 4,500,000 tons.

The amount expended during fiscal year ending June 30, 1893, was $25,000.

(See Appendix Z 1.)

2. Mississippi River between Missouri River and Minneapolis.—Under the head of "improving Mississippi River from the mouth of the Ohio River to Minneapolis," the river and harbor act of July 13, 1892, allots $600,000 for work between the Missouri River and Minneapolis, and the sundry civil act of March 3, 1893, contains a further allotment of $866,666.67, available July 1, 1893, for the same purpose. Reports on general improvements between those limits are combined under the above head.

Under this appropriation is carried on the improvement of through navigation.

has been in progress under approved projects since 1878, and
le results have been secured, showing that with a conti
ork under liberal appropriations the low-water chan
i River between St. Paul and the Missouri River
ively deep, available, and permanent. The inter

for which the improvement is being made are very large and important. The amount of freight carried during 1892, including the logs and lumber floated in the river, aggregated, approximately, 4,500,000 tons.

The original condition of the channel between the Missouri River and St. Paul was such that, in low stages, the larger boats were unable to proceed farther up the river than La Crosse or Winona; and in many seasons, at points much lower down, their progress was checked or seriously hindered. In all such cases through freight was reshipped on small and light-draft boats or barges. The originally adopted project for the improvement, which has not been materially changed, proposed the contraction of the channel or waterway by means of wing and closing dams to such an extent as, by means of the scour thereby caused, to afford a channel of sufficient width and of a depth of 4.5 feet at low water, to be eventually increased to 6 feet by further contraction.

There was expended on the permanent improvement of through navigation to June 30, 1892, the sum of $3,601,622.52, or $5,044.29 per mile. At that date, and for several years previous, the condition of the channel was such as to permit the passage of the largest boats at very low stages through to St. Paul.

During the past year work has been carried on by day's labor and use of Government plant between Minneapolis and St. Paul, between St. Paul and Lake Pepin, between Minneiska and La Crosse, at Rock Island Rapids, between Keithsburg and Montrose, at vicinity of Des Moines River, Hannibal, Hickory Chute, Louisiana, and Reeds Landing; by informal agreement between Minneapolis and St. Paul and between Reeds Landing and Minneiska, and by contract between Reeds Landing and Minneiska, between Genoa and Prairie du Chien, between Glenhaven and Dubuque, between Bellevue and Savanna, between Dubuque and Clinton, and between Keokuk and Quincy. The work of the year has resulted in increased width and depth of channel at all the points mentioned.

July 1, 1892, balance unexpended		$197,317.83
Amount appropriated by act approved July 13, 1892		600,000.00
Amount appropriated by sunday civil act approved March 3, 1893		866,666.67
		1,663,984.50
June 30, 1893, amount expended during fiscal year		446,138.30
July 1, 1893, balance unexpended		1,217,846.20
July 1, 1893, outstanding liabilities	$13,135.97	
July 1, 1893, amount covered by uncompleted contracts	267,422.78	
		280,558.75
July 1, 1893, balance available		937,287.45

Amount that can be profitably expended in fiscal year ending June 30, 1895 866,666.67
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.
(See Appendix Z 2.)

3. Des Moines Rapids, Mississippi River.—This work was commenced in 1867. The adopted plan provided for the building of a closed canal 8 miles long and for cutting an open channel in the rock bed of the river over the remaining 4 miles of rapids. The canal was opened in August, 1877, and has been in operation since that time.

During the past year a machine shop was built at Lower Lock and a small amount of repairs were made to the canal embankment. The work remaining to be done under approved project is the removal of a small amount of rock above grade in the open canal.

There has been appropriated and allotted for this work the sum of $4,574,950. The net cost to the United States has been to June 30, 1892, $4,554,519.39.

July 1, 1892, balance unexpended	$5,842.43
June 30, 1893, amount expended during fiscal year	3,161.98
July 1, 1893, balance unexpended	2,681.45

(See Appendix Z 3.)

4. Operating and care of Des Moines Rapids Canal and Dry Dock.—During the past year the Des Moines Rapids Canal was open for navigation 237 days, during which time there passed through it 670 steamboats and 234 barges, carrying 10,846 passengers, 31,318 tons of merchandise, and 53,257 bushels of grain. There also passed through 80,190,519 feet, B. M., of lumber, 16,350,200 feet of logs, 29,121,020 shingles, and 28,896,260 lath. The dry dock was in constant use during the whole year. The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of March 3, 1881. The amount expended during the year was $57,057.21. (See Appendix Z 4.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. A. Mackenzie, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. Hamburg Bay, on the Mississippi River, in Calhoun County, Ill.—Maj. Mackenzie submitted report of examination under date November 7, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the bay is worthy of improvement by the General Government to an extent justified by the interests concerned. The information now on hand and such additional surveys and examinations as can be made in connection with the improvement of the Mississippi River will permit the preparation, at any time, of project and estimate of cost of improvement at this locality. The report was transmitted to Congress and printed as House Ex. Doc. No. 26, Fifty-second Congress, second session. (See also Appendix Z 5.)

2. Mississippi River, Iowa side, from mouth of Iowa River to Burlington, to determine the best method of removing the bars and deepening the channel.—Maj. Mackenzie, in report of examination submitted under date of November 7, 1892, states that a "method of removing the bars and deepening the channel" of Mississippi River was adopted in 1878 and has been successfully followed since that time; that the section of the Mississippi River referred to is worthy of improvement; that work under the approved method mentioned has been in progress there for many years, and that surveys of portions of the section are being made continually in connection with such work of general improvement; no further survey is therefore required, and no special appropriations are needed for this work, it being practicable to allot such amounts as are necessary from the existing general appropriation for improving Mississippi River from mouth of Missouri River to Minneapolis. These views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed as House Ex. Doc. No. 88, Fifty-second Congress, second session. (See also Appendix Z 6.)

3. Harbor at Moline, Ill.—Maj. Mackenzie submitted report of examination under date of November 7, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government in the manner desired and proposed by the city of Moline. The report was transmitted to Congress and printed as House Ex. Doc. No. 30, Fifty-second Congress, second session. (See also Appendix Z 7.)

4. Mississippi River at and near Bellevue, Iowa, with a view to so repairing and fixing dam that ferry channel will be restored.—Maj. Mackenzie, in report of examination submitted under date of November 7, 1892, states that the Mississippi River in the vicinity of Bellevue is worthy of improvement, and the work of restoring the ferry channel by repairing and fixing the dam is a proper one, it being incidental to the work of channel improvement; no special survey of the locality is necessary, and no special appropriation is needed, appropriations being now available for the improvement of Mississippi River between the mouth of the Missouri and Minneapolis which can be properly applied to work on the dam when other work is carried out in the vicinity of Bellevue. The division engineer concurs in the views of Maj. Mackenzie, and it is the opinion of this office that the locality in question is worthy of improvement in the manner indicated. The report was transmitted to Congress and printed as House Ex. Doc. No. 83, Fifty-second Congress, second session. (See also Appendix Z 8.)

5. Lake Pepin, Mississippi River, as to whether additional harbors of refuge are necessary, and if necessary, where the same should be located.—Maj. Mackenzie submitted report of examination under date of November 7, 1892. It is his opinion that additional harbors of refuge on Lake Pepin are necessary and that the matter is worthy of considera- by the General Government; but that one such harbor located on the Minnesota shore near Kings Coulee will for the present at least serve all purposes of navigation. He also states that no additional special surveys are required in advance of the preparation of plans and estimates of cost of the work, and that such plans and estimates can be prepared from information now at hand or obtainable in connection with the general work of improving the Mississippi River. These views are concurred in by the division engineer and by this office. The report was transmitted to Congress and printed as House Ex. Doc. No. 52, Fifty-second Congress, second session. (See also Appendix Z 9.)

IMPROVEMENT OF MISSISSIPPI RIVER ABOVE FALLS OF ST. ANTHONY, MINNESOTA; OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARIES TO MISSISSIPPI RIVER, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA; GAUGING MISSISSIPPI RIVER AT ST. PAUL.

This district was in the charge of Maj. W. A. Jones, Corps of Engineers, with Lieut. Hiram M. Chittenden, Corps of Engineers, under his immediate orders to April 2, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Mississippi River above Falls of St. Anthony, Minnesota.—The present project, adopted in 1880, consists in the improvement of the river between Aitkin and Grand Rapids, a distance of 130⅛ miles, by removal of snags, bowlders, bars, and leaning trees from the channels and construction of wing dams where necessary to afford 3 feet depth at low-water stage, the cost being estimated at $54,127. In 1889 the estimate was increased to $63,000. Under the appropriations of 1880,

1881, and 1882, the river between the points named was well cleared of large numbers of obstructions. Between 1884 and 1888, and during the flood of the latter year, large numbers of snags and leaning trees were formed.

The appropriation of $10,000 made by act of August 11, 1888, was applied to removal of obstructions between Grand Rapids and a point about half-way to Aitkin, and in addition a number of bowlders was removed to within 20 miles of the latter point.

Before improvement commenced in 1880 the stream between Aitkin and Grand Rapids was so obstructed that navigation was difficult, and at times almost impossible for steamers of lightest draft.

The total expenditures under present project to June 30, 1892, including outstanding liabilities, were $61,177.86.

There was then a general depth in the improved channels of 3 feet at low water. A few bowlders, snags, and leaning trees offered some obstruction, but did not seriously interfere with navigation.

During the winter of 1892–'93, 130.25 cubic yards of bowlders was removed from the channel in the vicinity of Pine Knoll.

For a number of years previous to the present season several steamers have navigated this portion of the Mississippi, carrying passengers and freight to the settlements and supplies for lumber camps.

The opening, during the winter of 1889–'90, of the Duluth and Winnipeg Railroad from Duluth to the Mississippi River resulted in one steamer being withdrawn from the freight and passenger business, though at the beginning of the season of 1891 she was again put into commission.

July 1, 1892, balance unexpended	$1,843.06
June 30, 1893, amount expended during fiscal year	1,827.48
July 1, 1893, balance unexpended	15.58
July 1, 1893, outstanding liabilities	10.35
July 1, 1893, balance available	5.23

(See Appendix A A 1.)

2. Reservoirs at head waters of Mississippi River.—The object of the reservoirs is to collect surplus water, principally from the precipitation of winter, spring, and early summer, to be systematically released so as to benefit navigation on the Mississippi River below the dams. The reservoir project is the outcome of surveys and examinations made in 1869, 1874, 1878, and 1879. From the results of these examinations and further examinations made in 1880, the first cost of constructing reservoir dams in Minnesota and Wisconsin was placed at $1,809,083. The cost of land and other damages to result from construction and operation of the proposed dams was not included in that estimate, as they could not be predicted with any approach to accuracy.

The present project consists in constructing reservoir dams at head waters of the Mississippi River in Minnesota, that locality having been selected for commencing the work in consequence of an appropriation made by the river and harbor act approved June 14, 1880, for construction of a reservoir dam at Lake Winnibigoshish, Minnesota, and for other reasons given in Appendix Y to the Annual Report for 1886. By 1886 four of the reservoirs had been created. In the spring of 1891 the construction of a fifth reservoir at Sandy Lake was commenced, and one-half was built by the fall of 1892, but its completion has been delayed by the provision in the river and harbor act of Congress, July 13, 1892, providing for a navigable pass in the dam. Plans embodying the

modifications were drawn and submitted to a board of engineers for examination and report. The board approved the plans with one modification and the work is now in progress.

The total expenditures on this work to the close of the fiscal year ending June 30, 1892, including examinations at proposed dam sites, land damages, amounts paid to commissioners in attempted settlements of awards to Indians, and care and maintenance of the works, were $684,042.23.

During the past year the operations have been operating completed reservoirs, continuing construction of Sandy Lake Dam, building telephone line from Sandy Lake Dam to McGregor, Minn., building jam piers, and repairing gates at Pokegama Falls Dam.

The reservoirs were operated in 1885–'92 during the seasons of low water, to the benefit of navigation on more than 165 miles of the Mississippi River, viz, between Grand Rapids and Aitkin, 130⅛ miles, and from St. Paul to some distance below the confluence of the Mississippi and St. Croix rivers.

The sum of $20,000 is asked for the completion of navigable pass in Sandy Lake Dam.

July 1, 1892, balance unexpended	$39,781.61
Amount appropriated by act approved July 13, 1892	60,000.00
	99,781.61
June 30, 1893, amount expended during fiscal year	44,231.44
July 1, 1893, balance unexpended	55,550.17
July 1, 1893, outstanding liabilities	8,849.84
July 1, 1893, balance available	46,700.33
Amount (estimated) required for completion of existing project.	1,034,683.50
Amount that can be profitably expended in fiscal year ending June 30, 1895	51,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 2.)

3. Chippewa River, including Yellow Banks, Wisconsin.—The plan for improvement of the Chippewa River consists in revetment of caving bends and construction of dams and jetties from Eau Claire to the confluence of the Chippewa and Mississippi, a distance of 57 miles, to confine the low-water volume to a channel of nearly uniform width and depth. The general plan was adopted in 1877, and the work has been carried on in accordance with it, varying, however, more or less as to location and extent of dams, jetties, etc. The protection of the Yellow Banks consists in a revetment of piling and fascines, the latter to be crowned with rock. The object of the Yellow Banks protection is to prevent their erosion and thus relieve the channels of the Chippewa River and of the Mississippi below the junction of the two streams from the masses of sand contributed by those banks. The plan for protecting the banks was adopted in 1883. The improvement of the river and the protection of the Yellow Banks were regarded as separate and distinct works until the act of August 11, 1888. Estimated cost of the consolidated improvement, including all the expenses from the commencement, $272,487.72.

Before the improvement commenced the depth on the bars at low water seldom exceed 18 inches, and the crossing at the mouth of the river was extremely difficult at that stage owing to the volume of the river joining the Mississippi through a number of channels of insuffi-

cient depth. These latter-named channels were contracted into one of good depth by means of long parallel jetties. Generally, wherever works of improvement were constructed by the Government, the low-water depths were increased from 18 inches to 3 or 4 feet, and the general improvement not only greatly facilitated the passage of steamers and rafts, but also greatly reduced the expense of rafting manufactured lumber. Localities remaining to be improved have a least depth in the channel of about 2 feet.

No work, except slight repair, has been done at the Yellow Banks since 1883, when 4,978 linear feet of bank revetment had been completed and the piling for 3,275 feet had been driven ready for the backing of brush and stone.

The total expenditures from the commencement of operations in 1877 to June 30, 1892, including outstanding liabilities, were $165,574.78.

During the past fiscal year there has been constructed a brush and stone dam at Eau Galle Flats. Slight repairs were made to the Plum Island Flats Dam No. 3.

The new work is of too recent a date to indicate its permanent effect on the low-water channel.

July 1, 1892, balance unexpended	$1,713.98
Amount appropriated by act approved July 13, 1892	5,000.00
	6,713.98
June 30, 1893, amount expended during fiscal year	5,588.42
July 1, 1893, balance unexpended	1,125.56
July 1, 1893, outstanding liabilities	398.32
July 1, 1893, balance available	727.24
Amount (estimated) required for completion of existing project	100,737.72
Amount that can be profitably expended in fiscal year ending June 30, 1895	60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 3.)

4. St. Croix River, Wisconsin and Minnesota.—The original project for improvement, adopted in 1878, was based upon a survey made in 1874, when the river was at a high stage of water and but comparatively few obstructions to be seen. It contemplated removal of snags, bowlders, sand bars, etc., and contraction of low-water channels from Taylor Falls to the confluence of the river with the Mississippi into one of nearly uniform width. Estimated cost, $21,758. At low water, however, the channel had, in many places, but 2 feet depth, and steamers and barges made their way as best they could amongst the obstructions; at times it was impossible for them to get over the shoal places. The present project, adopted in 1880, and modified as to cost in 1882, and again in 1889, is based upon a low-water survey made in 1879, and differs from that originally adopted only in amount of work to be done. Estimated cost, $108,700.

The expenditures under present project to June 30, 1892, including outstanding liabilities, were $82,461.02.

The total expenditures under original and present projects to June 30, 1892, including outstanding liabilities, were $100,461.02.

The effect of the work of improvement has been to secure a least depth of 3 feet on the improved bars above Stillwater and 4 to 5 feet on the bars below that place. Generally, it may be said of this improvement that at many points navigation has been rendered permanent where formerly it was uncertain, and that in other places it has been made practicable where before improvement it was impossible.

In the improved parts of the river above Stillwater there is a low-water depth in the channel of 2 feet; below Stillwater there is a good channel with a least depth of 4 feet.

The work of improvement during the last year has consisted in removing a small bar at head of Lake St. Croix and in widening the channel over Hudson Bar by dredging. The work at Hudson enabled the raft boats, with their large tows to more easily make the run over the bar.

July 1, 1892, balance unexpended	$49.44
Amount appropriated by act approved July 13, 1892	8,000.00
	8,049.44
June 30, 1893, amount expended during fiscal year	5,220.49
July 1, 1893, balance unexpended	2,828.95
July 1, 1893, outstanding liabilities	341.16
July 1, 1893, balance available	2,487.79

Amount (estimated) required for completion of existing project	18,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	18,200.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 4.)

5. Minnesota River, Minnesota.—From 1867 to 1873, Congress appropriated $77,500 for improving the Minnesota River. The appropriations were applied to removing snags and bowlders, so as to afford a least depth at low-water stage of 2 to 3 feet. In 1874 a survey was made from the mouth of the river to South Bend, a distance of about 116 miles, to determine the practicability of improving the navigation by means of canals, locks, and dams. Based upon this survey, estimates were made for five locks and dams, and removal of snags, etc., at a cost of $733,868.63, the cost of removing snags, etc., being therein placed at $34,585.10, including contingencies. Following this report, Congress made three appropriations of $10,000 each, by acts approved March 3, 1875, August 14, 1876, and June 18, 1878, which sums were applied to clearing the river of obstructions below South Bend.

The expenditures to June 30, 1879, were $117,457.

Since 1879, no work for improvement of the river has been undertaken. Under the appropriations above named, the removal of obstructions cleared the way over long stretches of the river between Minnesota Falls and a point about 30 miles below Henderson (16.7 miles above Shakopee). Little or no use was made of the cleared channels, as there was not sufficient water in the channel to permit navigation during the low-water periods. The rapidly caving banks on the upper section of this stream cause snags and leaning trees to form, so that channels that cleared of them twelve years ago are more or less encumbered with them to-day.

No expenditures have been made for the improvement of the lower part of the river, which affords much better facilities for river traffic than the upper part.

From Shakopee to the Mississippi the river is deep except on two bars. There are few snags on this reach.

The river and harbor act of August 11, 1888, appropriated $10,000 for improving the Minnesota River, including protection of the banks opposite the borough of Belle Plaine. It appearing, from an examination made in September, 1888, that the sum was inadequate for the purposes named, its expenditure for work of improvement was deferred until the further wishes of Congress in the matter might be known.

The river and harbor act of July 13, 1892, made the sum available for the improvement of the river, omitting the requirement for operations at Belle Plaine. Under the latter act an examination of the mouth of the river was made and work of improvement will be carried on during the ensuing year.

The total expenditures on the improvement of the whole river to the close of the fiscal year ending June 30, 1892, were $117,542.79.

July 1, 1892, balance unexpended	$9,967.00
June 30, 1893, amount expended during fiscal year	93.45
July 1, 1893, balance unexpended	9,873.55
July 1, 1893, outstanding liabilities	18.54
July 1, 1893, balance available	9,855.01

Amount (estimated) required for completion of existing project	693,868.63
Amount that can be profitably expended in fiscal year ending June 30, 1895	35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 5.)

6. Red River of the North, Minnesota and North Dakota.—The project for the improvement of this river from Breckenridge to the northern boundary line, adopted in 1877 and amended as to cost in 1883, consists in the removal of snags, leaning trees, and bowlders, and in dredging channels through the bars at an estimated cost of $179,310. A revised estimate made in 1887, placed the cost of completing the improvement at $79,598.37. The engineer in charge submits in his report an estimate of $67,320 for the completion of the project. The last estimate has been necessitated by an increase in the quantity of material to be excavated and by the effect of the eight-hour law in increasing the cost of the work.

Before improvement, the ruling depth upon the bars between Moorhead and Goose Rapids at ordinary low water was but 1½ feet, and below Grand Forks, 2 feet, while between Moorhead and Abercrombie the navigation was at all times difficult.

The work to June 30, 1892, has resulted in opening a channel 3 feet deep at ordinary low water and 60 feet wide from Moorhead to a point 80 miles north, and a channel 4 feet deep at ordinary low water and averaging 60 feet wide from Grand Forks to a point 93 miles north by river; also in the removal of snags and trees between Moorhead and Abercrombie so as to afford safe passage for steamers between those points during high and medium stages of water.

The total amount expended, including outstanding liabilities, to June 30, 1892, was $214,180.60.

Dredging operations were continued during the past fiscal year and resulted in extending the dredged channels from a point 93 miles north of Grand Forks to the boundary line, and in improving 1 mile of Goose Rapids Flats. The improvement from Grand Forks north to the boundary line has now been completed.

July 1, 1892, balance unexpended	$2,067.05
Amount appropriated by act approved July 13, 1892	25,000.00
	27,067.05
June 30, 1893, amount expended during fiscal year	19,106.55
July 1, 1893, balance unexpended	7,960,50
July 1, 1893, outstanding liabilities	2,788.79
July 1, 1893, balance available	5,171.71

Amount (estimated) required for completion of existing project	$67,320.00
Amount that can be profitably expended in fiscal year ending June 30,1895	67,320.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix A A 6.)

7. Gauging Mississippi River at or near St. Paul, Minn.—The Board of Engineers, to whom was referred the project for the application of $37,500, appropriated by the river and harbor act of August 5, 1886, for reservoirs at headwaters of Mississippi River, recommended in their report dated May 24, 1887, "that such gaugings be made at or near St. Paul during the annual operation of the reservoirs as shall determine accurately the discharge at that point at critical periods." (Page 1692, Annual Report, Chief of Engineers, 1887.)

The river and harbor act of August 11, 1888, authorized the gaugings and provided for them as follows:

And the Secretary of War shall cause such gaugings to be made at or near St. Paul during the annual operation of said reservoirs as shall determine accurately the discharge at that point, the cost of the same to be paid out of the annual appropriation for gauging the waters of the Mississippi River and its tributaries.

* * * * * * *

SEC. 6. That for the purpose of securing the uninterrupted gauging of the waters of the Lower Mississippi River and its tributaries, as provided for in joint resolution of the twenty-first of February, eighteen hundred and seventy-one, upon the application of the Chief of Engineers, the Secretary of War is hereby authorized to draw his warrant or requisition from time to time upon the Secretary of the Treasury for such sums as may be necessary to do such work, not to exceed in the aggregate for each year the amount appropriated in this act for such purpose: Provided, however, That an itemized statement of said expenses shall accompany the Annual Report of the Chief of Engineers.

Gaugings were not made until the fall of 1889, although an allotment of $900 for the fiscal year ending June 30, 1889, had been made. On account of the lateness in the season and the condition of the river, it was not deemed advisable to expend any of the money that year.

The allotments of $600, $900, $900, and $500, made for fiscal years 1889–'90, 1890–'91, 1891–'92, and 1892–'93, were applied to gauging the Mississippi River at St. Paul, and, when necessary, the Minnesota River at its mouth.

During the past fiscal year 87 gaugings have been made.

July 1, 1892, balance unexpended	$45.22
Amount allotted for fiscal year ending June 30, 1893	500.00
	545.22
June 30, 1893, amount expended during fiscal year	431.23
July 1, 1893, balance unexpended	113.99
July 1, 1893, outstanding liabilities	113.99
Amount allotted for fiscal year ending June 30, 1894	500.00

(See Appendix A A 8.)

EXAMINATION OF KANSAS RIVER, KANSAS, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of Kansas River, required by act of July 13, 1892, was made by the local engineer, Lieut. Col. Charles R, Suter, Corps of Engineers, and report thereon submitted under date of February 9, 1893. It is his opinion, concurred in by this office, that the river is not at the present time worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 243, Fifty-second Congress, second session. (See also Appendix B B.)

IMPROVEMENT OF MISSOURI RIVER ABOVE SIOUX CITY, IOWA, AND OF YELLOWSTONE RIVER, MONTANA AND NORTH DAKOTA.

This district was in the charge of Capt. Charles F. Powell, Corps of Engineers, to April 27, 1893, and of Capt. Harry F. Hodges, Corps of Engineers, since that date; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Missouri River between the Great Falls, Montana, and Sioux City, Iowa.—Between Fort Benton, Mont., the head of navigation, and the Great Falls, 37 miles above, the river is seriously obstructed by rocks and has a steep slope. No work has been done upon it and none is proposed.

Between Fort Benton and Carroll, Mont., the channel was originally obstructed by bowlders, short turns, and steep slopes. On many bars there was insufficient low-water depth for boats drawing 30 inches. This stretch is 168 miles long and is called the "Rocky River." The original project called for the removal of bowlders. It was extended to include dredging and the building of cut-off and wing dams.

Up to June 30, 1893, $365,930.61 had been expended on the present project for the Rocky River. The worst bowlders had been removed, dams had been built at various points, and some dredging had been done. The channel had been deepened to 36 inches at the improved places except at extreme low water.

Before the adoption of the above-named project, work had been done on the river above and below the Great Falls under an appropriation of $160,000 for improving the Missouri River above the mouth of the Yellowstone.

The part done on the Rocky River consisted of dam construction and rock removal.

During the year ending June 30, 1892, work on the Rocky River had had been suspended, as there appeared no likelihood of boats running there during the approaching season. The plant has been cared for and kept in repair.

Below Carroll, Mont., the river is known as the "Sandy River." From there down it becomes more and more unstable and carries more and more sediment. The banks in the bottoms cave and numerous shoals exist. Floods and ice gorges occasionally cause cut-offs or radical shifting of the channel. Originally the principal difficulties met with by navigation were due to the bars, snags, and instability of the channel. The river was avilable for boats drawing 30 inches, if skillfully piloted.

The original project for the general improvement contemplated the removal of snags and other obstructions, and the completion of a detailed survey with publication of charts. The construction of an ice harbor at Rockhaven was subsequently added. In 1878 to 1882 some work of regulation was done near Vermillion, S. Dak. None has since been undertaken.

Up to June 30, 1893, there has been expended:

In removal of snags, etc	$149,824.33
In survey and plotting before 1884	63,401.21
In survey and plotting since 1884	163,111.82
In preparatory work on ice harbor	2,227.97
In work before adoption of present project	159,168.14

On June 30, 1892, the snagging fleet consisted of one steel-hulled steamer, one wooden-hulled steamer, and one steel-hulled scow, all quite proper appliances for the work. During the year ending June

30, 1893, these boats removed 684 snags, 53 miscellaneous obstructions, and sluiced several bad bars. The fleet has been extensively repaired during the year, and the scow is now fitting with steam-propelling machinery.

The removal of many dangerous obstructions renders the channel more available for navigation than it was originally, but no attempt has been made to permanently deepen or rectify it.

Up to June 30, 1892, the river survey parties had completed the primary leveling to Fairbank, S. Dak., the tertiary triangulation, hydrography, and shore line to Cannonball, N. Dak., and the triangulation and bank topography to Fairbank.

The plotters had completed 63 of the detail charts and 1 small-scale chart. Fifty-eight detail charts and 9 small-scale charts were partially finished. Fifty detailed charts were in the hands of the printer.

During the year the field work of the survey was nearly completed. There remains only the duplication of the primary levels for a distance of 267 miles, the shore-line topography and hydrography for a distance of 15 miles, and the topography of the bottom land for a distance of 94 miles.

The plotters during the year have finished 59 detail charts and 8½ small-scale charts; and have partially finished 69 detail charts and 1 small-scale chart. Thirteen editions of the detail charts and proofs of 2 others have been received from the printer.

On June 30, 1892, the elevation for the ice harbor had been surveyed. The plans are now complete. It is hoped to do the greater part of the work in the autumn.

July 1, 1892, balance unexpended		$110,986.81
Amount received by refundment of overpayment		41.60
Amount appropriated by act approved July 13, 1892		150,000.00
		261,028.41
June 30, 1893, amount expended during fiscal year		100,900.94
July 1, 1893, balance unexpended		160,127.47
July 1, 1893, outstanding liabilities	$9,725.00	
July 1, 1893, amount covered by uncompleted contracts	13,775.00	
		23,500.00
July 1, 1893, balance available		136,627.47

Amount (estimated) required for completion of existing project	*175,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	*175,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix C C 1.)

2. Removal of snags and other obstructions in Missouri River above Sioux City, Iowa.—The approved project contemplates the use of the available funds in the work stated on that part of the Missouri River above Sioux City where boats may be running and where the work is most needed.

But one appropriation has been made for this work, that by the sundry civil act of March 3, 1893, $50,000.

The work of the snag boats has been carried on under the general appropriation for improving the Missouri River between the Great Falls, Montana, and Sioux City, Iowa, and will be found reported under that head.

* Exclusive of $50,000 annually for removal of snags, etc.

Amount appropriated by sundry civil act approved March 3, 1893	$50,000.00
July 1, 1893, balance unexpended	50,000.00
Amount (estimated) required for work annually. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	50,000.00

(See Appendix C C 2.)

3. Examination of Missouri River between Three Forks and Canyon Ferry, Mont., to determine availability of water power.—The river and harbor act approved July 13, 1892, appropriated $2,500 for an examination of Missouri River from Three Forks to Canyon Ferry, Mont., with a view of determining at what points, if any, use might be made of water power for manufacturing and other purposes, without unreasonably impairing the navigability of that portion of the river.

The project for the work contemplates examination of the maps of the survey made on this part of the river in 1890 by the Missouri River Commission, personal examination of the localities, and such additional field work as may be found necessary.

During the year ending June 30, 1893, the personal examination of the locality was made. The remainder of the work is reserved for the low water of early autumn, when it can be most advantageously done.

Amount appropriated by act approved July 13, 1892	$2,500.00
July 1, 1893, balance unexpended	2,500.00

(See Appendix C C 3.)

4. Yellowstone River, Montana and North Dakota.—Originally the channel of the river was so obstructed by rocks, swift rapids, sharp turns, and insufficient depth at bars as to be nearly impassable to any vessels at low water.

The original project contemplated rock removal at various points of the river and the construction of closing dams and wing dams at some places below Glendive. A survey was also projected.

Up to June 30, 1892, a total of $103,029.13 had been expended on the improvement, and $19,000 on the survey. The result has been to give a navigable channel of 3 feet in depth at the points improved above Glendive, and 3 feet or more at the points improved below that place. The survey has been finished. During the year ending June 30, 1893, no work has been done. For reasons given in Appendix X 2 of the Annual Report, Chief of Engineers, 1887, the project is suspended for further action of Congress. There was formerly a brisk river traffic. There is none now.

July 1, 1892, balance unexpended	$11,720.87
July 1, 1893, balance unexpended	11,720.87
July 1, 1893, outstanding liabilities	.71
July 1, 1893, balance available	11,720.16

(See Appendix C C 4.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *James River, South Dakota*, required by act of July 13, 1892, was made by the local engineer, Capt. Charles F. Powell, Corps of Engineers, and his report thereon, dated February 28, 1893, was submitted through the division engineer, Col. O. M. Poe, Corps of Engineers. It is the opinion of Capt. Powell and that of the

division engineer, concurred in by this office, that the river is not now worthy of improvement by the General Government. (See Appendix C C 5.)

IMPROVEMENT OF OBION RIVER, TENNESSEE, AND OF CUMBERLAND RIVER, TENNESSEE RIVER ABOVE CHATTANOOGA AND BELOW BEE TREE SHOALS, AND THEIR TRIBUTARIES, TENNESSEE AND KENTUCKY.

This district was in the charge of Lieut. Col. Henry M. Robert, Corps of Engineers, with Capt. John Biddle, Corps of Engineers, under his immediate orders to June 9, 1893, and in the charge of Capt. Biddle since that date.

1. Obion River, Tennessee.—This stream is a tributary of the Mississippi and flows wholly within the State of Tennessee. It rises in the western part of that State, runs in a southwesterly direction, and has a length of about 75 miles. An examination was made in 1880, and a survey was made in 1891, under provisions of river and harbor act approved September 19, 1890, from Obion to the mouth of the river, a distance of 68.8 miles, having a fall of 27 feet.

The obstructions were found to be heavy drift, snags, overhanging trees, and a tortuous channel.

The project consists of removing surface obstructions, constructing wing dams at the worst shoals, straightening the channel by cutting through several sharp "bends," making the "cut-offs" sufficiently wide and deep by clearing, grubbing, and excavating, closing the old channel by means of pile and brush dams, to secure a navigable channel not less than 3 feet deep at lowest stages, estimated to cost $50,000.

The appropriation of $7,500 in river and harbor act of July 13, 1892, was the first made for this work by the General Government.

In October boats were built and work begun. The channel was cleared of surface obstructions from Obion to Lane Ferry, about 22 miles. Work was suspended by high water in December. In March operations were resumed by clearing away the snags that could not be reached during the first season's work. The drift gorges that completely closed the channel at several points were cut through. A small steamer, with barges in tow, passed up the Obion in May, being the first steamboat reaching that town during the past fifty years. It is reported that the work done has given great satisfaction to the river interests.

The amount expended during the present fiscal year, including outstanding indebtedness, was $5,466.99.

Amount appropriated by act approved July 13, 1892	$7,500.00
June 30, 1893, amount expended during fiscal year	5,454.99
July 1, 1893, balance unexpended	2,045.01
July 1, 1893, outstanding liabilities	12.00
July 1, 1893, balance available	2,033.01
Amount (estimated) required for completion of existing project	42,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D D 1.)

2. Tennessee River—a. Above Chattanooga, Tenn. (188 miles).—This section of the river extends from the mouth of the French Broad River to

Chattanooga, and is usually navigable during the winter and spring months. Examinations were made in 1830 and 1871, and a detailed instrumental survey in 1891–'93. The obstructions were described as "low-water obstructions," consisting of reefs, rock or gravel bars, and snags, etc., brought down by freshets. The depth on these bars varies from 10 to 30 inches at a low-water stage, the current being from 2½ to 6 miles per hour.

The original project, under which the work is still carried on, was to blast a channel through the reefs, reduce the gravel and sand bars, and to deepen the water on the bars by the construction of wing dams, thus contracting the waterway so as to secure a safe, navigable channel, 3 feet in depth at average low water.

The amount expended to June 30, 1892, including outstanding indebtedness, was $269,303.10, which expenditure has resulted in securing a lengthened season of navigation for steamboats and a safer channel for the passage of rafts and flatboats. Of the 43 obstructions enumerated in 1830, channel work has been carried on to the extent of improving at least 29 of them. Owing to the character of the banks these improvements are practically permanent. At White Creek Shoals the longitudinal dam has been lengthened and two spur dams built, causing the removal of the sand bar to deep water. At Soddy Shoals the channel has been carefully examined and preparations made for drilling and blasting the rock forming the dangerous reefs of this obstruction. Three dams have also been repaired.

The steamer *McPherson* proving unsuitable for the work on the Upper Tennessee was sold to the work of improving the Tennessee River between Chattanooga and foot of Bee Tree Shoals, and a light-draft steamer, *Stephen H. Long*, was constructed during the fiscal year for use above Chattanooga.

At Soddy Shoals work was carried on for about four months, August to December, removing from the channel about 650 cubic yards of rock, 145 snags, and 267 overhanging trees; 4,052 cubic yards of dam was built and 1,496 cubic yards of old dam calked. During the winter the fleet was moored at Chattanooga. In April the fleet was moved to Caney Creek Shoals and the quarrying stone for the dams was begun; this work was in progress at the close of the fiscal year.

The amount expended, including outstanding indebtedness during the fiscal year ending June 30, 1893, was $22,786.98.

July 1, 1892, balance unexpended	$1,842.93
Received from sale of steamer *McPherson*	2,400.00
Amount appropriated by act approved July 13, 1892	25,000.00
	29,242.93
June 30, 1893, amount expended during fiscal year	20,675.35
July 1, 1893, balance unexpended	8,567.58
July 1, 1893, outstanding liabilities	2,111.63
July 1, 1893, balance available	6,455.95
Amount (estimated) required for completion of existing project	44,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	44,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Survey of Tennessee River between Chattanooga and the junction of Holston and French Broad rivers, Tennessee.—The river and harbor act approved September 19, 1890, provided $15,000, or so much thereof as may be necessary, to be used in making a careful and comprehensive

survey of Tennessee River from Chattanooga to the junction of the Holston and French Broad rivers, with a view of ascertaining to what extent the navigation of the river is capable of improvement, and the cost of the same and the preparation of suitable plans therefor.

The survey was conducted under the direction of Lieut. Cols. John W. Barlow and Henry M. Robert, Corps of Engineers, and a report upon it was submitted by the latter under date of February 23, 1893.

Lieut. Col. Robert states that this portion of the Tennessee River, a reach 188 miles in length, is capable of being made navigable to a depth of 5 feet at low water without the use of locks and dams, but at great cost, roughly estimated at $3,000,000. He considers that an improvement to a depth of 3 feet, which is greatly needed and can be obtained at reasonable and justifiable cost, should be first undertaken before projecting further improvement. The cost of a 3-foot channel is estimated at $650,000.

The reports were transmitted to Congress and printed as House Ex. Doc. No. 252, Fifty-second Congress, second session; they are also submitted with Appendix D D 2 of this report.

b. Below Bee Tree Shoals, Alabama (225 miles).—This section of the river is generally navigable during the greater part of the year, though several obstructions render navigation difficult during the low-water season.

No instrumental survey has been made of this section of the river, nor estimates and project submitted for its improvement, and it is very necessary that such a survey be made to obtain data whereon to base estimates and a project for the improvement of the Lower Tennessee. The work required to be done is channel excavation and construction of wing dams to widen, straighten, and deepen the channel at the principal obstructions.

Livingston Point, Kentucky.—The river and harbor acts of September 19, 1890, and July 13, 1892, each appropriated $25,000 for the preservation of Livingston Point, Kentucky, which, with two small islands, forms Paducah Harbor, at the mouth of the river. The plan of improvement adopted consisted in covering the wearing slopes of the banks with a revetment of stone and brush and the construction of a pile and stone dike along the crest of the weakest part of the point, where the Ohio cuts through at high stages of the river.

The amount expended, including outstanding indebtedness, to June 30, 1892, was $22,964.30. This expenditure secured the construction of the dike on the Ohio side for a distance of 660 feet across the washout near the extremity of the point. The bank protection covers a length of 2,330 feet, the average width being 47 feet. This work was done under contract.

During the present fiscal year a contract was entered into for furnishing stone and brush in place, necessary for the construction of about 3,000 feet of shore protection at Livingston Point, Kentucky. Work was carried on during December and April by depositing 2,000.47 cubic yards of stone in place. High water prevented operations during the other months of the fiscal year.

The amount available for this work during the past fiscal year was $27,035.70. The amount expended during the year was $1,459.29, leaving a balance unexpended July 1, 1893, of $25,576.41, of which $9,886.32 was covered by uncompleted contracts. The amount (estimated) required for completing the existing project for Livingston Point is $130,000.

The money statement is included in that for improving Tennessee River below Chattanooga, page 310.

(See Appendix D D 2.)

3. Hiwassee River, Tennessee.—This stream rises in the Blue Ridge in North Carolina and Georgia. It flows in a west-northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga and 48 miles below Knoxville. On examination made in 1874 the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees.

The present project consists in narrowing the waterway at the shoal places by building wing dams and excavating the reefs and gravel bars and removing surface obstructions so as to secure a channel 40 feet wide and 2 feet deep at ordinary low water from Savannah Ford to the mouth of the river, about 43 miles.

The amount expended to June 30, 1892, including outstanding indebtedness, was $35,338.78, and has resulted in a partial improvement of the river, securing an increased depth in channel and the removal of surface obstructions, principally below Charleston.

From July 1 to September 10, a small force was employed at Matthew Shoals. A part of the main dam opposite the lower island was removed and a new spur dam built out from the right bank to back up the water on the shoal. Satisfactory results were attained to the extent of reducing the velocity of the current opposite the lower island. The other dams were raised and repaired and the banks protected by a facing of felled trees and brush held in place by stone riprap. The channel below Matthew Shoals was also cleared of surface obstructions.

The amount expended during the fiscal year, including outstanding indebtedness, was $1,442.16. No appropriation was made by the river and harbor act of July 13, 1892, for the Hiwassee River.

July 1, 1892, balance unexpended	$1,492.27
June 30, 1893, amount expended during fiscal year	1,419.12
July 1, 1893, balance unexpended	73.15
July 1, 1893, outstanding liabilities	23.04
July 1, 1893, balance available	50.11

(See Appendix D D 3.)

4. French Broad River, Tennessee.—This stream rises on the western slopes of the Blue Ridge in North Carolina, and enters the State of Tennessee at Paint Rock, and after a course of 121 miles in that State joins the Holston, 4½ miles above Knoxville, thus forming the Tennessee River.

By examinations made in 1871 and 1875 the river was found to be obstructed by rock reefs, sand and gravel bars, and surface obstructions, such as bowlders, snags and overhanging trees. It was not deemed practicable to improve the river above Leadvale, but from this point to the mouth, a distance of about 90 miles, it is projected to remove all surface obstructions, and by excavation and use of wing dams to secure for this distance a channel depth of 2½ feet at ordinary low water. Above the mouth of Nolichucky River (Leadvale) to the boundary line of Tennessee and North Carolina a system of locks and dams is the only feasible improvement, but the amount of commerce does not warrant such an expenditure.

The amount expended to June 30, 1892, including outstanding indebtedness, was $47,984.24. This expenditure has resulted in the improvement of ten of the principal obstructions below Dandridge, by

deepening and clearing the channel, constructing and modifying wing dams, and revetting the banks where necessary. At Seven Island Shoals the improvements have made upstream navigation possible at lower stages of the river. A general deepening of the channel from 6 to 10 inches has been obtained. At Bryant Shoals navigation has been greatly improved; at Hanging Rock Shoals the channel has been changed from the north to the south side of Brabson Island, and the new channel was cleared of obstructions without detention of boats; eight dams were built, aggregating a length of 2,694 linear feet. The work done has proved effective.

During the fiscal year the operations were limited, being mostly in the nature of repairs at Hanging Rock Shoals and consisted of riprapping the bank with stone, raising and repairing the dams, and clearing the channel of surface obstructions. When the work is completed, the chute at these shoals will be one of the safest and easiest to navigate on the river. A light-draft steamer, about 14 inches, was built especially for use upon this stream and the Upper Tennessee.

The amount expended, including outstanding indebtedness, during the fiscal year, was $4,712.87. The work done and projected will materially aid navigation and the development of the mining and agricultural interests along the valley of the river.

One thousand dollars has been allotted from the appropriation of $15,000, made by act of July 13, 1892, for this river, to be applied to removing bar in Little Pigeon River.

July 1, 1892, balance unexpended	$189.39
Received from sale of steamer *McPherson*	900.00
Amount appropriated by act approved July 13, 1892	14,000.00
	15,089.39
June 30, 1893, amount expended during fiscal year	3,759.31
July 1, 1893, balance unexpended	11,330.08
July 1, 1893, outstanding liabilities	953.56
July 1, 1893, balance available	10,376.52
Amount (estimated) required for completion of existing project	88,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D D 4.)

5. Little Pigeon River, Tenneesee.—Little Pigeon River is formed by the junction of its East Fork and South Fork at Sevierville, in East Tennessee, flows in a northwesterly direction for about 5 miles, and empties into the French Broad River about 42 miles above Knoxville. The stream is obstructed by rock and gravel shoals and rapids, and the object of its improvement would be to facilitate navigation during medium and higher stages.

An examination of the river was made under the provisions of river and harbor act of September 19, 1890, and the reports thereon were printed as House Ex. Doc No. 159, Fifty-first Congress, second session, and as Appendix E E 8, Annual Report, Chief of Engineers, 1891.

The river and harbor act of July 13, 1892, provided that of the $15,000 appropriated for improving French Broad River, $1,000 "may be used in removing the bar or shoal in Little Pigeon River." This sum has been allotted for the removal of the bar near the mouth of the river, described as the only bad shoal below Catlettsburg. During the fiscal year no work was done.

Amount allotted under act approved July 13, 1892	$1,000.00
July 1, 1893, balance unexpended	1,000.00

(See Appendix D D 4.)

6. Clinch River, Tennessee.—This stream rises in the Cumberland mountains in Virginia, and after following a southwesterly course empties into the Tennessee River at Kingston, 104 miles above Chattanooga. About 230 miles of the river flows in the State of Tennessee.

An examination was made in 1875, when the channel obstructions were found to be rock reefs, sand and gravel bars, snags, and overhanging trees.

The present project provides for channel excavation, removing surface obstructions, and the construction of wing dams, so as to secure a safe navigable channel of 2 feet at ordinary low water from mouth of river to Clinton, about 70 miles, and of 1½ feet from Clinton to Haynes or Walkers Ferry, about 75 miles; but from Haynes to the Tennessee State line, 85 miles, the only work practicable is to remove the loose rock and reduce the rock ledges, thus to assist flat-boat navigation during "rain tides."

The engineer officer in charge reports that $50,000, the estimate of 1885, is wholly inadequate to do the work projected, and recommends that a detailed survey be made to obtain the data necessary to determine the cost.

The total amount expended to the close of the fiscal year ending June 30, 1892, including outstanding indebtedness, was $34,962.29, and has resulted in securing a reduction of the rock reefs, the removal of snags, drift, etc., brought down by the annual floods, and the construction of several heavy riprap dams above and below Haynes; a safe channel was secured at stages of the water from 2 to 3 feet lower than before the improvements were begun. Special advantages in the lower river have been gained at Cloud Shoals, Hibb Shoals, Black Shoals, Bletcher Shoals, and at Llewellyn Shoals. At the last-named obstruction safe navigation is reported possible at a stage of water from 1 foot to 1½ feet lower than before the work of 1892 was begun. Some improvements were also made in 1892 in the channel at Youngs Island. Above Haynes improvements were made at Hunter Shoals, Sycamore Shoals, Hopson Shoals, and Straight Shoals.

No work in the channel was done during the present fiscal year. Partial examinations were made in July below the mouth of Powell River, and later below the mouth of Emory River, to ascertain in part what is necessary to be done to improve the channel and obtain a navigable 2-foot low-water depth.

The total amount expended during the present fiscal year, including outstanding indebtedness, was $917.81.

July 1, 1892, balance unexpended	$111.55
Amount appropriated by act approved July 13, 1892	4,000.00
	4,111.55
June 30, 1893, amount expended during fiscal year	888.97
July 1, 1893, balance unexpended	3,222.58
July 1, 1893, outstanding liabilities	28.84
July 1, 1893, balance available	3,193.74
Amount (estimated) required for completion of existing project	11,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	11,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix D D 5.)

7. Cumberland River, Tennessee and Kentucky.—a. Below Nashville (191 miles).—An examination was made of this section in 1871, and the channel was found to be of the same general character throughout its entire length and obstructed by rock reefs, bowlders, gravel and sand bars, snags, and overhanging trees.

The original project provides for the removal of the surface obstructions and deepening the channel by excavation and the building of wing dams. This project was modified in 1888, on the recommendation of a board of engineer officers, by the proposed construction of a pile dike with crib superstructure for the improvement of the channel at the mouth of the river, from Smithland to the deep waters of the Ohio, for which Congress made provision in river and harbor act of September 19, 1890. A survey was made in 1889, having in view a project for the radical improvement of the river below Nashville, and "to ascertain if necessary to establish locks and dams." The river and harbor act of July 13, 1892, provided for the selection and purchase of sites for a lock and dam near the mouth of Harpeth River. The total amount expended to June 30, 1892, including outstanding indebtedness, was $287,694.70. This expenditure has resulted in obtaining an increased depth at low water at some of the worst obstructions and thereby securing a lengthened season of navigation, and from year to year in clearing the channel of snags and other surface obstructions. Good progress was made on the work of building dike and stone protection at mouth of river under contract. The old spur dams were shortened so as to increase the channel width. The shore of Cumberland Island in the vicinity was protected by riprap. Buoys or floats were placed on the dams at the principal obstructions to mark location of dams at high water.

During the present fiscal year the work of dike construction was continued at mouth of the river; 1,047 piles were driven; 6,577¾ cubic yards of stone and 351 cords of brush were placed in dike. The old dams, extending from Cumberland Island to head of dike, were entirely removed.

During September and October about 3,150 linear feet of bank above foot of Cumberland Island were protected by driving 1,092 piles near the low-water line, and by placing 6,041 cubic yards of stone and 545 cords of brush as a revetment.

In September the survey was begun, having in view the selection of sites for lock and dam near mouth of Harpeth River, as provided by act of July 13, 1892. The field work of this survey was finished in April and the maps in June. The sites recommended, located about 2½ miles below the mouth of Harpeth River, were approved by the Secretary of War June 12. Action will be taken without unnecessary delay to acquire title to these sites.

The expenditures during the fiscal year were, for general improvement, $12,074.67; at mouth of river, $8,698.92; lock and dam near mouth of Harpeth River, $4,768.72.

July 1, 1892, balance unexpended		$17,462.16
Amount appropriated by act approved July 13, 1892		40,000.00
		57,462.16
June 30, 1893, amount expended during fiscal year		25,542.31
July 1, 1893, balance unexpended		31,919.85
July 1, 1893, outstanding liabilities	$214.86	
July 1, 1893, amount covered by uncompleted contracts	6,695.00	
		6,909.86
July 1, 1893, balance available		25,009.99

Amount (estimated) required for completion of existing project.....$153,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 153,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

b. Above Nashville.—From Nashville to head of Smith Shoals (337 miles).—The present project is based on an instrumental survey of this section made in 1883, and provides for the complete canalization of the river from Nashville to head of Smith Shoals, by the construction of 23 locks and dams below Burnside, and 7 locks and 2 dams at Smith Shoals, at an estimated cost of $7,500,000; of this amount $775,000 has been appropriated.

The amount expended to June 30, 1892, including outstanding indebtedness, was $143,039.26. This expenditure has been applied to the purchase of sites of locks and abutment of Dams Nos. 1 and 2; fencing United States lands; constructing lock-keepers' house No. 1; excavating lockpits and building cofferdams at Locks 1 and 2; laying about 37 per cent of the masonry of lock and abutment of Dam 1; making survey of upper approach to Lock 1, and test borings at sites of Lock 2; surveying lands for sites of Locks 3 and 4; rebuilding and refitting snagboat *Weitzel*; clearing the channel of surface obstructions; reducing rock and gravel bars; extending and repairing riprap dams in order to maintain the improvements already secured.

During the present fiscal year, 3,040 cubic yards of earth and 14 cubic yards of rock were removed and 697.4 cubic yards of masonry laid in the abutment of Dam 1, completing the same. At Lock 1, 1,155.3 cubic yards of earth and 430.4 cubic yards of rock were removed, and 2,487.5 cubic yards of masonry laid. No work was done at Lock 2. Actual operations having established the fact that solid rock can not be found for the foundation of Lock No. 2 at anything like the depths specified in the contract for its construction, and that the character of the site at the depths so specified is altogether too insecure for the masonry of the lock, the contract of February 24, 1891, with Messrs. Rich & Holmes, for building Lock No. 2, was terminated in accordance with its provisions. Detailed surveys of several localities were made from which to select the sites of Locks and Dams Nos. 3 and 4. The sites selected have been approved; that of No. 3 at Buttermilk Shoals, and of No, 4 at Bandy Shoals, about 26 miles and 45 miles respectively above Nashville. Land for the site of abutment of Dam 3 has been purchased and title vested by deed in the United States. Proceedings in condemnation have been instituted to acquire the sites for Locks 3 and 4 and abutment of Dam 4, and action thereon was pending at the close of the fiscal year.

A dredge was bought for general use on the upper river. In June, while the stage of water permitted, the lumber for cofferdams and temporary buildings, bricks for use in lock construction, rails for tramways, machinery and a large part of the plant on hand were moved to the sites of Locks 3 and 4, so as to be available for use when the titles to the sites are vested in the United States. Authority was granted in March last to do the entire work by hired labor and purchase of materials in open market, it being recommended by the engineer officer then in charge as being more advantageous in time and money to the work than the contract system. Proposals were, however, solicited for supplying cut stone for the locks, by contract; bids to be opened July 11, 1893.

The work begun last June of clearing the channel of surface obstructions was continued from Neelys Shoals to Nashville. The

chute at Holleman Island was carried out to the left bank by removing the spur dam running from left bank to island and rebuilding the dam on right bank; the new chute was thoroughly cleared of surface obstructions.

At Smith Shoals an instrumental survey was begun in July to obtain the data necessary whereon to determine the sites for the projected locks and dams between Burnside and the mouth of Rockcastle River. Detailed examinations have been made and maps nearly finished showing the proposed sites of the two lower locks of the series.

The amount expended, including outstanding indebtedness, during the fiscal year, was $119,294.70, of which the sum of $5,773.44 was expended at Smith Shoals.

July 1, 1892, balance unexpended		$383,417.11
Amount appropriated by act approved July 13, 1892		250,000.00
		633,417.11
June 30, 1893, amount expended during fiscal year		93,983.25
July 1, 1893, balance unexpended		539,433.86
July 1, 1893, outstanding liabilities	$25,311.45	
July 1, 1893, amount covered by uncompleted contracts	56,063.30	
		81,374.75
July 1, 1893, balance available		458,059.11
Amount (estimated) required for completion of existing project		6,725,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

c. Above mouth of the Jellico, Kentucky.—Under the provisions of the act of September 19, 1890, the $5,000 appropriated by act of August 2, 1882, has been expended in the removal of snags and sand bars in the Cumberland River above Nashville, of which sum $77.98 was expended during the present fiscal year. For detailed report of work done in channel see Reports of Chief of Engineers, 1891 and 1892.

July 1, 1892, balance unexpended	$77.98
June 30, 1893, amount expended during fiscal year	77.98

(See Appendix D D 6.)

8. Caney Fork River, Tennessee.—This stream, after a course of about 200 miles, wholly in the State of Tennessee, empties into the Cumberland River at Carthage, Tenn., about 116 miles above Nashville, Tenn. It is the largest and an important tributary of the Cumberland River.

An examination was made in 1879 as high up as Sligo Ford, about 72 miles, and in 1886 it was extended 20 miles farther to Frank Ferry, the head of navigation. The principal difficulties were found to be rock reefs, gravel and sand bars, a crooked, shallow channel, greatly impeded by surface obstructions.

The present project is to improve the river below Frank Ferry, 92 miles, by removing drift and other surface obstructions, and building the wing dams and training walls necessary to insure safe navigation for small steamboats and flatboats during the boating season, usually about five months in duration, from February to July.

The amount expended to June 30, 1892, including outstanding indebtedness, was $24,966.62, which was used in removing surface obstructions, in reducing sand and gravel bars, and in repairing and building

dams, and has resulted in a greatly improved channel at the 3-foot stage above low water from Frank Ferry to mouth of river.

Work in the channel was suspended August 15, 1891, the appropriation being then nearly exhausted.

Amount expended during the fiscal year, including outstanding indebtedness, was $53.38, which exhausted the total amount appropriated.

July 1, 1892, balance unexpended	$53.38
June 30, 1893, amount expended during fiscal year	33.38
July 1, 1893, balance unexpended	20.00
July 1, 1893, outstanding liabilities	20.00

Amount (estimated) required for completion of existing project	20,228.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,228.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix D D 7.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. Henry M. Roberts, Corps of Engineers, and reports thereon submitted:

1. Ohio River between Livingston Point and the head of Tennessee Island, with the view of protecting the harbor and marine ways at Paducah, Ky.—Lieut. Col. Robert submitted report of examination under date of August 23, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government for the purpose proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 107, Fifty-second Congress, second session. (See also Appendix D D 8.)

2. Duck River, Tennessee.—Lieut. Col. Robert submitted report of examination under date of October 7, 1892. It is his opinion, concurred in by this office, that the river is worthy of improvement by the United States. No survey will be necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 33, Fifty-second Congress, second session. (See also Appendix D D 9.)

3. Sequatchie River, Tennessee.—Lieut. Col. Robert submitted report of examination under date of August 23, 1892. It is his opinion, concurred in by this office, that the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 60, Fifty-second Congress, second session. (See also Appendix D D 10.)

4. Hiwassee River, in Tennessee, from its confluence with the Tennessee River to the mouth of the Ocoee River.—Lieut. Col. Robert submitted report of examination under date of August 22, 1892. It is his opinion, concurred in by this office, that the river is worthy of improvement by the General Government. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $2,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 27, Fifty-second Congress, second session. (See also Appendix D D 11.)

5. Emory River, Tennessee, from its mouth to Harriman.—Lieut. Col. Robert submitted report of examination under date of August 22, 1892. It is his opinion that Emory River is worthy of improvement by the General Government, provided it can be done at a reasonable cost, which can only be determined by a survey, the cost of which is estimated at $600. The report was transmitted to Congress and printed as House Ex. Doc. No. 21, Fifty-second Congress, second session. (See also Appendix D D 12.)

IMPROVEMENT OF TENNESSEE RIVER BETWEEN CHATTANOOGA, TENNESSEE, AND FOOT OF BEE TREE SHOALS, ALABAMA.

This district was in the charge of Capt. George W. Goethals, Corps of Engineers; Division Engineer, Col. C. B. Comstock, Corps of Engineers.

1. Tennessee River between Chattanooga, Tenn., and foot of Bee Tree Shoals, Alabama.—The original condition of the river from Chattanooga to Browns Ferry, as shown by examinations made in 1867 and subsequently, was unfavorable to navigation, the channel being obstructed by rock reefs, bars, bowlders, and projecting rocky points, permitting the passage of vessels from six to nine months annually. From Browns Ferry to Florence it was navigable only at unusually high-water stages, owing to the obstructions known as Big and Little Muscle Shoals. Navigation between Florence and Riverton, Ala., was limited to about six months annually, owing to the obstructions known as Colbert and Bee Tree Shoals.

The existing project of improvement is as follows:

a. Removing obstructions by blasting and dredging at Ross Towhead, in "The Suck," and at Bridgeport and Guntersville, Ala.

b. Building a canal 14.5 miles long, 70 to 120 feet wide and 6 feet deep to permit navigation past the river obstructions known as Big Muscle Shoals; the canal to have nine locks, each 60 feet wide by 300 feet long, and to cross Shoal Creek by means of an aqueduct 900 feet long and 60 feet wide. Constructing a canal 1½ miles long, to enable vessels to avoid the obstructions known as the Elk River Shoals; this canal to have two locks, one at each end.

c. Blasting a channel through bed rock and building wing dams at Little Muscle Shoals; the project as modified in 1890 contemplates the building of a canal along the north bank of the river 3 miles long, with two locks.

d. Constructing a canal 8 miles long, 150 feet wide and 7 feet deep, past the Colbert and Bee Tree Shoals obstructions, with one guard lock at the upper and one lock with 25-foot lift at the lower end; these locks to be 80 feet wide and 350 feet long.

The total amount expended to June 30, 1892, including outstanding liabilities, was $3,556,529.70, and resulted in the improvement of the river as follows:

Navigation through "The Suck" and the Pan was rendered easier by the removal of bowlders, detached rock, overhanging trees, and projecting rocky points. At Elk River and Big Muscle Shoals the locks, gates, valves, and machinery for properly operating them were completed; the aqueduct and permanent stone dams finished; houses for lock-keepers and assistants, a dredge and towboat for use of the canal built, and the canal opened to navigation the year round. At Little Muscle Shoals the channel was deepened by blasting, and wing dams built in accordance with the original project, giving increased depth. At Colbert and Bee Tree Shoals increased depth was obtained

by excavating a channel and contracting the waterway by means of riprap dams; survey of location for proposed lateral canal was completed and center line permanently marked by stone monuments.

The amount expended during the fiscal year, including outstanding liabilities, was $167,422.41, for which the following work was done:

Chattanooga, Tenn., to Decatur, Ala.—The channels through Tumbling Shoals, Poor Horse and Broad Axe bars were straightened and deepened by blasting, and the low-water fall reduced, making navigation easier. At Ross Towhead and Guntersville a considerable quantity of rock and gravel was removed under contract, resulting in increased depth of channel at these localities. At Bridgeport some of the obstructing rock ledges were blasted and gravel removed from the channel by dredging. The gap in Beards Reef was cleared of obstructing rocks, giving a straight channel 120 feet wide and 3 feet deep.

Decatur, Ala., to Florence, Ala.—A large quantity of stone was quarried at both divisions of the canal, and after being broken was placed on the inner slopes of the longitudinal dam and canal embankments throughout their entire length to tighten them; the effect of the broken stone, in addition, is to protect slopes from wash by passing vessels and the embankments from ravages by muskrats. An obstructing towhead which had formed in the channel above Lock A was removed; the channel below Lock B was deepened and widened by dredging; the wooden snubbing posts at the various locks and below Lock 9 were replaced with iron ones; filling and grading were done behind lock walls and lock-keepers' houses where needed; certain Government lands and lock-keepers' houses were inclosed by fences. A building to be used as quarters for foremen was completed; a machine shop was constructed and fitted up with necessary machines for repairing lock machinery, tools, and appliances, and arrangements made to operate the machines by steam or water power; quarters were arranged for laborers; a ditch about 1,100 feet long was dug as an outlet for overflow from Six Mile waste weir, and new ties were placed on railway track over Six Mile and Bluewater weirs.

Florence, Ala., to foot of Bee Tree Shoals.—The test pits and examinations needed to determine the nature of foundation for the lock were completed. By a modification of the project it is proposed to substitute a single lock of 25-foot lift for the two locks contemplated in the modified project of 1891. Bids for the construction of this lock were opened May 15, and a contract was awarded just before the close of the fiscal year. Satisfactory arrangements were made and authority granted to purchase 305.35 acres of land needed for canal purposes, and of this amount 82.07 acres was purchased and paid for. The channel opposite Colbert Island was straightened and deepened by the removal of a number of detached rocks and by repairing a break in the longitudinal dam. In order to determine the depth of rock on the site of lock walls a number of borings were made.

Four hundred and seventy-five thousand dollars of the appropriation of July 13, 1892, for improving Tennessee River below Chattanooga, was allotted to this reach, making, with the balance already on hand, $626,353.91 available for work. Of this amount $149,027.64 was expended during the year, not including outstanding liabilities, July 1, 1893, $18,394.77, and the amount covered by uncompleted contracts on that date, $38,093.85. The amount estimated as required to complete the existing project for this reach is $5,707,939.81. Two million dollars can be profitably expended in the year ending June 30, 1895.

The money statement for this work is consolidated with that for Tennessee River below Bee Tree Shoals, page 300. so as to embrace the entire reach of the river below Chattanooga, as follows:

Tennessee River below Chattanooga.

July 1, 1892, balance unexpended		$153,389.61
Amount appropriated by act approved July 13, 1892		500,000.00
		653,389.61
June 30, 1893, amount expended during fiscal year		150,486.93
July 1, 1893, balance unexpended		502,902.68
July 1, 1893, outstanding liabilities	$18.394.77	
July 1, 1893, amount covered by uncompleted contracts	47,980.17	
		66,374.94
July 1, 1893, balance available		*436,527.74

Amount (estimated) required for completion of existing project	5,837,939.81
Amount that can be profitably expended in fiscal year ending June 30, 1895	2,130,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix E E 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—The canal has been in constant use since it was opened to navigation, November 10, 1890. The number of steamboats, barges and miscellaneous craft, exclusive of Government boats engaged in the improvement of the Tennessee River and care of the canal, that used the canal during the year was 223.

A most serious break occurred on the morning of June 1, just above Lock 3, owing to an unprecedented rainfall of 3.6 inches in less than nine hours; without warning a section of the towpath 75 feet in length and extending to bed rock, 23 feet below the railway track, was carried away. By working night and day the damage was repaired in time for two vessels to pass through on the 3d of the month.

The accumulation of sediment in the canal required frequent dredging; 38,964 cubic yards of material was thus removed during the year, besides about 1,500 logs which had drifted in the channels leading to the canal proper.

The total expenses during the year, including outstanding indebtedness, amounted to $55,975.19.

(See Appendix E E 2.)

IMPROVEMENT OF OHIO, MONONGAHELA, CHEAT, ALLEGHENY, AND MUSKINGUM RIVERS.

This district was in the charge of Lieut. Col. Amos Stickney, Corps of Engineers, with Lieut. Harry F. Hodges, Corps of Engineers, under his immediate orders from August 15, 1892, to April 23, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Ohio River.—The following is a summary of the work done during the fiscal year:

Logstown.—Work was commenced at this place upon a modification of the old riprap curved dike, so as to place it in a line perpendicular to the shore, and other spur dikes were planned to improve the low-

*A contract for $305,766.60 of this amount has been awarded.

water channel. A vigorous opposition to the change was made by the Pittsburg Coal Exchange, and work was suspended and a board of engineer officers convened to examine the site and report upon the plans. The board recommended the construction of the cross-dike in place of the upper part of the training dike, and one other spur dike, but, in view of the strong opposition of the coal-boat operators, considered it advisable to omit from the plans the work that was intended for improving the low-water channel.

Ice pier at Kerrs Run.—This work was completed during the year.

Dikes at Eight Mile Bar.—Supplementary works were constructed at this point, for the purpose of improving the channel opposite the dike built in 1885–'86. Two loose stone spur dikes were constructed, one 450 feet and one 210 feet in length. They were located at right angles to the current, and carried up to an elevation 4 feet above low water. Observations taken subsequently indicated a considerable improvement in the channel, as regards depth, width, and general direction.

Rock bar at mouth of Licking River.—A steam drilling scow for the removal of the rocky bar in the mouth of Licking River, by blasting and subsequent dredging, is now in process of construction.

Cullums Ripple.—A hired dredge was employed from November 15 to November 20, 1892, in removing snags and small drift, which had become so tightly packed as to form an obstruction in the channel opposite the dike at Cullums Ripple. Sixteen snags and seventeen cords of drift were removed and disposed of in such a manner that no further danger to navigation could result.

Great Miami Embankment.—Enlargement of this embankment has been completed, so far as funds under the allotment would permit, and the work may be considered completed.

Rising Sun.—A hired dredge with towboat and barges was employed, from November 11 to November 30, in widening and straightening the channel opposite the upper dike on the Indiana shore at Rising Sun. Three thousand three hundred and twenty cubic yards was removed by dredging, and by this removal a very much larger quantity was scoured out by the current, so that a greatly improved channel resulted.

Dike at Madison, Ind.—This work was completed during the year.

Embankment at Shawneetown.—This was enlarged and the work under the allotment completed in May, 1893.

Brooklyn Harbor.—By the river and harbor act of July 13, 1892, the sum of $10,000 was allotted for the purpose of improving the harbor at Brooklyn, Ill. The work of improvement was a continuation and extension of that done in 1884 and 1888. The United States dredges commenced work in October, 1892, and continued until December 17, 1892, when they were stopped by high water. Thirty-nine thousand two hundred and eighty-six and four-tenths cubic yards of pudding stone, gravel, and mud was removed during this time.

Dike at middle of Grand Chain.—This dike, which has been a long time in building on account of unfavorable stages of the river, was completed with a total length of 3,008 feet.

Operations of United States dredges.—The dredges after undergoing repairs started down the river from Cincinnati August 16, 1892. Dredging was done at French Island, Bowlesville, Caseyville, Sisters, resulting in the removal of 24,230.6 cubic yards of sand, 16,805.5 cubic yards of loose rock, sand, and gravel, one wreck, and eight snags. After performing this work the dredges were employed at Brooklyn Harbor.

Gauging low-water discharge of Ohio River.—Measurements were made of the low-water discharge below the mouths of the principal streams tributary to the Ohio River. This was accomplished during the low-water stage of the river which prevailed during the month of October and early portion of November, 1892, and furnishes valuable information.

Surveys.—Special surveys of the river were made at Clusters, Rising Sun, Scuffletown, and at Eight Mile Bar.

The amount expended up to close of fiscal year ending June 30, 1892, was $5,081,947.33.

July 1, 1892, balance unexpended		$58,186.44
Transfer settlements		129.40
Amount appropriated by act approved July 13, 1892		360,000.00
		418,315.84
June 30, 1893, amount expended during fiscal year		106,787.29
July 1, 1893, balance unexpended		311,528.55
July 1, 1893, outstanding liabilities	$15,831.31	
July 1, 1893, amount covered by uncompleted contracts	79,979.17	
		95,810.48
July 1, 1893, balance available		215,718.07

Amount that can be profitably expended in fiscal year ending June 30, 1895 1,000,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix F F 1.)

2. Operating snag-boat on Ohio River.—The repairs made to the snag boat *E. A. Woodruff* were only those of the most urgent character. The boat worked from August 8 to December 16, 1892, 131 days, and in this time removed 532 snags, 1 rock, and 45 wrecks. The total distance traveled was 2,121½ miles. The officer in charge earnestly recommends an increase of the amount of money to be made applicable to this work each year, as the amount of $25,000 per year now provided by permanent annual appropriation made by act of September 19, 1890, is not sufficient to keep the snag boat fully employed and in repair. An increase to $50,000 per year would, it is believed, permit this service to be so thorough as to add largely to the safety of navigation and make the service entirely satisfactory.

The amount expended on this work up to the close of the fiscal year ending June 30, 1892, was $37,400.

(See Appendix F F 2.)

3. Operating and care of Davis Island Dam, Ohio River, near Pittsburg, Pa.—This dam was built to test the adaptability of the system of movable dams to the peculiar condition of the Ohio River, and to the special character of the commerce that navigates it. It was intended to be the first step in the radical improvement of the Ohio River, designed to give a minimum depth of 6 feet at all times, except when ice was running. Incidentally this dam has been of great value to the city of Pittsburg, by securing an ample depth of water in its harbor throughout the low-water season. It has also been of immense benefit to the coal trade by enabling them to bring loaded boats out of the Monongahela River at any time. The natural harbor room of Pittsburg is very limited, and before the Davis Island Dam was built the great bulk of coal barges were held in the Monongahela. In short rises the amount of coal that could be shipped south was absolutely limited by the number of barges that could be locked through the lowest dam

in the Monongahela during the passage of the rise. Under present conditions this limit no longer exists, and all coal can now be shipped for which towboats are available. During the fiscal year the lock and dam have been successfully operated without interference with navigation, except during the time that necessary repairs were being made to the lower gate. The dam has been raised and lowered two times, and has been up 164 days during the fiscal year. The cost of operating and care of the dam during the year was $12,501.25.

(See Appendix F F 3.)

4. Movable dam in Ohio River below mouth of Beaver River, Pennsylvania.—Three hundred and fifty thousand dollars was appropriated for this work by acts of September 19, 1890, and July 13, 1892. All the temporary buildings were erected, and the plant required in the construction of the permanent work was purchased and placed in position. The cofferdam for the lock was completed November 11, 1892, inclosing 6.3 acres. The permanent foundations for boiler house were completed and the drift chute for lock was completed for a distance of 292 feet. The excavations for foundations of the river wall of lock were commenced October 7, 1892. The cofferdam was injured, but not materially, during the winter.

Movable Dam No. 2, Ohio River.—The river and harbor act of July 13, 1892, provided for the use of so much of the money appropriated for the movable dam at Beaver as might be necessary for making a survey for the location of a dam, No. 2, and for obtaining title to the land. The survey has been made.

The amount expended on this work up to the close of the fiscal year ending June 30, 1892, was $6,745.24.

July 1, 1892, balance unexpended		$243,254.76
Amount appropriated by act of July 13, 1892		100,000.00
		343,254.76
June 30, 1893, amount expended during fiscal year		90,404.31
July 1, 1893, balance unexpended		252,850.45
July 1, 1893, outstanding liabilities	$9,225.19	
July 1, 1893, amount covered by uncompleted contracts	74,022.25	
		83,247.44
July 1, 1893, balance available		169,603.01

Amount (estimated) required for completion of existing project for Lock and Dam No. 6	550,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix F F 4.)

5. Monongahela River, West Virginia and Pennsylvania.—The seven lower locks and dams on the Monongahela River belong to the Monongahela Navigation Company, and they create slack water from Pittsburg to Dunkard Creek, a distance of 88 miles. Locks and Dams Nos. 8 and 9, belonging to the United States, continue this slack water to Morgantown, a further distance of 14 miles, the distance from Pittsburg to Morgantown being 102 miles. The originally adopted project for the improvement of this river was the construction of two locks and dams to continue slack water to Morgantown, W. Va. This improvement was completed in 1889.

Lock No. 10.—By the river and harbor act of July 13, 1892, the sum of $25,000 was appropriated for beginning work on Lock and Dam No. 10. A survey was made for the purpose of determining the location of the

lock, and from the data thus obtained it would appear that the most favorable site would be at some point on the first mile above Morgantown.

The amount expended on this work up to the close of the fiscal year ending June 30, 1892, was $436,541.52.

July 1, 1892, balance unexpended	$358.48
Amount appropriated by act approved July 13, 1892	25,000.00
	25,358.48
June 30, 1893, amount expended during fiscal year	1,759.99
July 1, 1893, balance unexpended	23,598.49
July 1, 1893, outstanding liabilities	251.94
July 1, 1893, balance available	23,346.55
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	100,000.00

(See Appendix F F 5.)

6. Operating and care of Locks and Dams Nos. 8 and 9, Monongahela River.—These locks have been successfully operated during the fiscal year without interruption to navigation, except by the ice, which closed the river from December 26, 1892, to February 2, 1893. The lower entrances to both locks were dredged out and slight repairs made to the locks and dams. Storage sheds were constructed at both locks, and at No. 9 work was begun on two lock-keepers' dwellings. The banks below Lock No. 8 were partially protected by riprap, and at No. 9 a portion of the apron to dam was repaired; a new step was constructed and the top course of masonry at lock repaired.

The cost of operating and care of these locks and dams during the year was $28,170.85.

(See Appendix F F 6.)

7. Purchase of Lock and Dam No 7, Monongahela River.—The river and harbor act of August 11, 1888, made provision for the acquisition by the United States, by purchase or condemnation, of this lock and dam from the Monongahela Navigation Company. Condemnation proceedings for this purpose were instituted. The case was heard in the circuit court of the United States for the western district of Pennsylvania in November, 1890, and the value of the work was fixed at $209,000. The navigation company took an appeal to the Supreme Court of the United States, where the case was argued at the October term, 1892. The judgment of the circuit court was reversed and case remanded, with instructions to grant a new trial.

July 1, 1892, balance unexpended	$161,835.45
July 1, 1893, balance unexpended	161,835.45

(See Appendix F F 7.)

8. Purchase of Lock and Dam No. 6, Monongahela River.—An appropriation of $162,000 was made by river and harbor act of September 19, 1890, for acquisition of this structure from the Monongahela Navigation Company, after title to Lock and Dam No. 7 shall have been acquired by the United States. As the latter has not yet been obtained, no steps have been taken toward negotiating for Lock and Dam No. 6.

July 1, 1892, balance unexpended	$167,000.00
July 1, 1893, balance unexpended	167,000.00

(See Appendix F F 8.)

9. Cheat River, West Virginia.—The channel of this river was originally filled with rock obstructions, which interfered with the free passage of drifting logs, thereby making the transportation of timber from the head waters of this river to the markets along the Monongahela and Ohio rivers very hazardous. The river has been improved by the removal of rocks, and is now in fair condition between Rowlesburg and Green Island, a distance of 20¼ miles. As the appropriation for the improvement was exhausted, no further work was done during the past fiscal year.

The amount expended on the project to June 30, 1892, was $12,992.50.

July 1, 1892, balance unexpended	$7.50
July 1, 1893, balance unexpended	7.50

(See Appendix F F 9.)

10. Allegheny River, Pennsylvania.—The original condition of the Allegheny River as to depth, width, and navigability can not be stated in definite figures, as there is no defined plane from which to measure, both the low-water line and the elevation of the river bed being variable. The approved project for the improvement of the river is the removal of obstructions from the channel and the construction of low dams to close double channels, and of dikes to confine the waterway where the river is too wide. Much benefit to navigation has resulted. The late day when the appropriation of July 13, 1892, became available rendered it inexpedient to begin much new work during that season. The amount available will be expended during the coming season in building dikes and dams and removing obstructions.

The following is the condition of the various works:

Log chute at Corydon, Pa., 209 miles above Pittsburg.—Slight repairs were made and the work is now in good order.

Dam at Cornplanter Island, 204 miles above Pittsburg.—The dam is in good condition.

Dam at Hickory, 157 miles above Pittsburg.—Slight repairs are now required by reason of injuries received from the ice of last winter. The dam is otherwise in good condition.

Dam at Pithole, 143 miles above Pittsburg.—This dam is in good condition.

Dam at Red Bank, 64 miles above Pittsburg.—Slight repairs were made to the paving of back slope. The ice of last winter slightly damaged the paving of front slope, which should be repaired. The dam is otherwise in good condition.

Nicholsons Island, 37 miles above Pittsburg.—Slight repairs were made to the paving, and a small quantity of the paving displaced by last winter's ice now requires to be replaced. The dam is otherwise in good condition.

Dam at Six Mile Island, 6 miles above Pittsburg.—This work is in good condition.

Removal of bar at Pithole Ripple, 143 miles above Pittsburg.—The work of removing this bar was continued. During the year 2,740 cubic yards of bowlders and gravel was removed. The work is now completed, with a total removal of 3,240 cubic yards of material, and one of the worst obstructions in the Allegheny River is now out of the way.

Surveys.—A survey and map was made of 2 miles of river at Cowanshannock, Pa., 48 miles above Pittsburg, for the purpose of determining the location and kind of dike best adapted for the improvement of the shoal at that place.

Encroachments.—The action taken against parties encroaching on the river has had the effect of restraining further encroachments to a very considerable extent. All parties reported as encroaching have been ordered to desist when it was proved that they were so doing.

The amount expended on this project to the end of the last fiscal year was $178,377.85.

July 1, 1892, balance unexpended	$1,622.15
Amount appropriated by act approved July 13, 1892	25,000.00
	26,622.15
June 30, 1893, amount expended during fiscal year	3,564.69
July 1, 1893, balance unexpended	23,057.46
July 1, 1893, outstanding liabilities	150.00
July 1, 1893, balance available	22,907.46
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix F F 10.)

11. Dam at Herr Island, Allegheny River, near Pittsburg, Pa.—The object of this dam is to begin a system of slack-water navigation and enlarge the harbor room at Pittsburg to the extent of the pool formed by the dam. The original project was for a fixed dam, but, in compliance with the request of the authorities of Pittsburg and Allegheny City, the Secretary of War has ordered that the dam at Herr Island be made a movable one. Much delay was caused by suits brought by the riparian owners, but by a change of location, so that the lock was placed out from the bank, the rights of the riparian owners were preserved, and their opposition was withdrawn. The land necessary for the lock and dam has been acquired, and all legal questions as to damages to adjoining property settled. Observations of the current and water levels at site of dam have been taken, and borings made for the purpose of determining the character of the river bed. Preparations have been also made for the construction of the cofferdam for the lock.

The amount expended on this work to June 30, 1892, was $39,208.25.

July 1, 1892, balance unexpended	$68,696.85
Amount appropriated by act approved July 13, 1892	40,000.00
	108,696.85
June 30, 1893, amount expended during fiscal year	931.21
July 1, 1893, balance unexpended	107,765.64
July 1, 1893, outstanding liabilities	145.60
July 1, 1893, balance available	107,620.04
Amount (estimated) required for completion of existing project	484,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	200,000.00

(See Appendix F F 11.)

12. Ice harbor at mouth of Muskingum River, Ohio.—The object of this work was to furnish a place of refuge for Ohio River craft during ice floods. The project was the construction of a large lock through Dam No. 1, Muskingum River, to permit Ohio River vessels to pass into the pool. There has been expended thereon, up to the close of the

fiscal year ending June 30, 1892, $327,930.29. The lock is now practically completed, with the exception of the machinery for operating the gates, and a small amount of masonry required to finish the lock walls. The lock can not be made available for the larger class of steamboats that usually navigate the Ohio and Muskingum rivers until the bridge of the Baltimore and Ohio Southwestern Railroad Company, just below it, has been changed. No steps have been taken by the railroad company to make the required alterations.

July 1, 1892, balance unexpended	$50.78
June 30, 1893, amount expended during fiscal year	10.10
July 1, 1893, balance unexpended	40.68
Amount that can be profitably expended in fiscal year ending June 30, 1895. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

(See Appendix F F 12.)

13. Muskingum River, Ohio.—This report is limited to work carried on under the appropriation of $102,000, by act of August 11, 1888, for the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, Ohio. During the fiscal year a survey of the river was made, covering a distance of 4,400 feet, between the head of the canal at Zanesville and a point 500 feet above the old lock, to obtain information as to the best plan for the reconstruction of the lock at this point. The lock at Taylorsville is now practically completed with the exception of the machinery for operating the gates, but this lock can not be made available until a draw is placed in the county bridge, just below it. The commissioners of Muskingum County, to whom the bridge belongs, were ordered to change it, but thus far have not done so.

The amount expended on this work up to the close of the fiscal year ending June 30, 1892, was $86,666.02.

July 1, 1892, balance unexpended	$15,517.98
June 30, 1893, amount expended during fiscal year	1,763.41
July 1, 1893, balance unexpended	13,754.57

(See Appendix F F 13.)

14. Operating and care of locks and dams on Muskingum River, Ohio.—As originally improved by the State of Ohio, 11 dams and 12 locks were built on the Muskingum River, furnishing continuous navigation for 91 miles from the Ohio River at Marietta to Dresden, where a connection was made with the Ohio Canal near its middle point, this canal extending from the Ohio River, at Portsmouth, to Lake Erie, at Cleveland. The work cost the State of Ohio about $1,500,000. The lock and dam above Zanesville is now in a state of ruin, but the 75 miles of slack water between the Ohio River and Zanesville has always been maintained. On this piece of river there are 10 dams, 11 locks, and 5 lateral canals, with a total length of 3⅞ miles. The repairs to locks and dams contemplated in the project for fiscal year have been completed, and necessary incidental work done. Through navigation was suspended by reason of ice and excessive floods for a period of forty-five days. The failure of part of the old dam at Stockport (No. 6) rendered the lock useless until a coffer could be placed around the break, which, after many delays, was accomplished. The improved condition of the river was very noticeable during the low water of 1892, when a 6-foot stage was maintained in the river at a time when navigation was practically suspended on the Ohio River for want of sufficient water to per-

mit boats to run. The bridges at Taylorsville and Marietta still constitute great obstructions to navigation on the Muskingum River, the first-named preventing the use of the new lock at Taylorsville, and the latter preventing the larger class of boats from entering the lock and ice harbor at Marietta, and causing much inconvenience and danger to smaller boats. The United States dredge and towboat have been usefully employed during the year in various operations for the maintenance of good channels.

The cost of operating and care of these works during the year was $44,251.10.

(See Appendix F F 14.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. Amos Stickney, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. *Ohio River at or near Elizabethtown, Ill.*—Lieut. Col. Stickney submitted report of examination under date of August 31, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the Ohio River at this point is worthy of improvement by the General Government, provided the cost is not unreasonable. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $600. The report was transmitted to Congress and printed as House Ex. Doc. No. 111, Fifty-second Congress, second session. (See also Appendix F F 15.)

2. *Harbor at Evansville, Ind.*—Lieut. Col. Stickney submitted report of examination under date of August 31, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $300. The report was transmitted to Congress and printed as House Ex. Doc. No. 115, Fifty-second Congress, second session. (See also Appendix F F 16.)

3. *Ohio River between the cities of Ludlow and Covington, in Kentucky, and Cincinnati, Ohio, from the Chesapeake and Ohio Railway Bridge to the Cincinnati Southern Railway Bridge, to prevent washing and damage to banks on Kentucky shore.*—Lieut. Col. Stickney submitted report of examination under date of December 19, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 157, Fifty-second Congress, second session. (See also Appendix F F 17.)

4. *Little Miami River, Ohio, with the view of affording an ice harbor.*—Lieut. Col. Stickney submitted report of examination under date of October 18, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government for the purpose named. The report was transmitted to Congress and printed as House Ex. Doc. No. 68, Fifty-second Congress, second session. (See also Appendix F F 18.)

5. *Ohio River between Ironton, Ohio, and 3 miles along and up the Ohio east of the mouth of Guyan River, West Virginia.*—Lieut. Col. Stickney

submitted report of examination under date of September 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of such improvement by the General Government as can be made at reasonable cost. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $2,500. The report was transmitted to Congress and printed as House Ex. Doc. No. 121, Fifty-second Congress, second session. (See also Appendix F F 19.)

6. Raccoon River, Ohio, from its junction with the Ohio River for 50 miles of said Raccoon River.—Lieut. Col. Stickney submitted report of examination under date of September 2, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 116, Fifty-second Congress, second session. (See also Appendix F F 20.)

7. Location of the necessary number of movable dams and locks on the Ohio River between Davis Island Dam and the dams at or near the mouth of the Beaver River, in Pennsylvania.—Lieut. Col. Stickney submitted report of examination under date of October 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that this portion of Ohio River is worthy of improvement by the General Government. Col. Stickney estimates the cost of surveys necessary for preparation of project and estimate of cost of improvement at $2,800. The report was transmitted to Congress and printed as House Ex. Doc. No. 45, Fifty-second Congress, second session. (See also Appendix F F 21.)

8. For lock and dam at the most practicable point for navigation on Allegheny River between the (proposed) dam at Tarentum and Herr Island Dam, Pennsylvania.—Lieut. Col. Stickney submitted report of examination under date of October 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the Allegheny River within the limits mentioned is worthy of improvement by the General Government. Lieut. Col. Stickney estimates the cost of surveys necessary for preparation of project and estimate of cost of improvement at $2,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 87, Fifty-second Congress, second session. (See also Appendix F F 22.)

9. For lock and dam on Allegheny River at or near Tarentum, Pa.—Lieut. Col. Stickney submitted report of examination under date of October 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river at this point is worthy of improvement by the General Government in the manner proposed. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 37, Fifty-second Congress, second session. (See also Appendix F F 23.)

10. Allegheny River from Olean, N. Y., to Warren, Pa.—Lieut. Col. Stickney submitted report of examination under date of September 30, 1892. It is his opinion and that of the division engineer, concurred in by this office, that within the limits named the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 61, Fifty-second Congress, second session. (See also Appendix F F 24.)

EXAMINATION MADE IN COMPLIANCE WITH SUNDRY CIVIL ACT APPROVED MARCH 3, 1893.

The sundry civil act approved March 3, 1893, required an examination and survey to be made by board of Ormsby Creek, in the first ward, and mouth of Mill Creek, in the twenty-first ward, of Cincinnati, Ohio, or in the vicinity of either or both of those localities for an ice harbor. Lieut. Col. Lydecker has been charged with the duty of making the examination and survey, and the reports thereon will be submitted when received.

IMPROVEMENT OF FALLS OF OHIO RIVER, OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF WHITE RIVER, INDIANA.

This district was in the charge of Lieut. Col. G. J. Lydecker, Corps of Engineers, with Lieut. Hiram M. Chittenden, Corps of Engineers, under his immediate orders since April 4, 1893.

1. Falls of the Ohio River, at Louisville, Ky.—The object of the improvements in progress is to afford increased facilities for passing the Falls of the Ohio, via the Louisville and Portland Canal, by enlargements at its upper end and immediately above the locks, so as to form capacious basins or harbors at these points. The work at the head of the canal is also associated with the improvement of the Indiana Chute, or the river channel over the falls which becomes a line of descending travel when the river rises to a height of about 10 feet on the upper canal gauge, and is the only route with the gauge reading 12.7 feet, or more, when the canal locks can not be operated.

The canal enlargement at the head was inaugurated in 1883, the original project being afterward modified to conform with the recommendations made by a board of engineers in its report of January 28, 1890. Under the approved project the width of canal—now 90 feet—is to be made from 210 to 235 feet for a length of 2,400 feet, and east of this the enlarged canal will expand into a basin 800 feet wide by 2,200 feet long; the principal features of the work, as estimated, were 325,670 cubic yards of rock excavation and 270,000 cubic yards of earth excavation, the construction of about 5,200 linear feet of masonry wall and dams containing about 26,000 cubic yards, and the removal of 6,200 linear feet of old canal wall, dikes, and timber dams. The work done to June 30, 1893, comprised 174,245.03 cubic yards rock, 212,019.31 cubic yards earth excavation, and 13,678.83 cubic yards of masonry in new canal wall, of which 13,362.63 cubic yards rock and 34,486.50 cubic yards earth were excavated and 3,371.27 cubic yards of masonry laid during the fiscal year ending on that date.

The enlargement above the locks was begun in 1887 with the object of constructing a basin 1,500 feet long and 250 feet wide, where boats can tie up and tows be properly formed before or after passing the locks without obstructing navigation through the canal. The work is nearly completed, the results accomplished to June 30, 1893, being 17,744.60 cubic yards rock and 141,593 cubic yards earth excavation and 5,807 cubic yards masonry laid in new wall.

The total expenditure on these improvements to June 30, 1893, was $716,951.17, of which $98,261.74 was expended in the fiscal year ending on that date.

Special attention is invited to the fact that these improvements have been in progress, under small appropriations for the work to be done, since 1883, and no benefit whatever has yet been secured to commerce, because of their unfinished state. Further, the work is of such a character that small appropriations must increase the ultimate cost in a

peculiarly marked degree, because each season's operations can be inaugurated only after a very large expenditure for arrangements for that season's work, and the same expenditure must be repeated year after year while the work is in progress. For these reasons it is urged that means be supplied to complete the work in two good working seasons, and to this end that the next appropriations be not less than $300,000. By this course, and not otherwise, commerce may realize by 1895 a large part of the advantages contemplated by the work done and expenditures made since 1883.

July 1, 1892, balance unexpended	$44,963.72
Amount appropriated by act approved July 13, 1892	60,000.00
	104,963.72
June 30, 1893, amount expended during fiscal year	98,261.74
July 1, 1893, balance unexpended	6,701.98
July 1, 1893, outstanding liabilities	1,596.65
July 1, 1893, balance available	5,105.33
Amount (estimated) required for completion of existing project	550,008.89
Amount that can be profitably expended in fiscal year ending June 30, 1895	300,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G G 1.)

2. Indiana Chute, Falls of the Ohio River.—This is the main channel of the river over the Falls of the Ohio. Originally it was very crooked with most irregular rock bottom, and swift, whirling currents. By removing the most prominent rocky projections it has been so improved that a large part of the river traffic can now descend by that route when the stage of water is up to, or above, 10 feet on the upper canal gauge. In 1890 a project for its more radical improvement was adopted, the object being to make it safely navigable when the river is not below a stage of 8 feet on the canal gauge. Commerce will be thereby relieved at such times from the delays incident to passing the falls via the Louisville and Portland Canal and locks, an advantage which will be of the greatest importance to the heavy coal traffic, which alone amounts to about 1,700,000 tons annually. Nearly all this traffic would then follow the improved Indiana Chute, as the shipments of coal, when the river is at a lower stage than 8 feet, are exceedingly small.

During the past year good progress was made on this work, 27,586.62 cubic yards of solid rock having been excavated and 1,864 linear feet of stone dikes built.

The amount expended on the improvement of this chute to June 30, 1893, is $187,858.45.

July 1, 1892, balance unexpended	$27,523.76
Amount appropriated by act approved July 13, 1892	35,000.00
	62,523.76
June 30, 1893, amount expended during fiscal year	50,378.08
July 1, 1893, balance unexpended	12,145.68
July 1, 1893, outstanding liabilities	180.56
July 1, 1893, balance available	11,965.12
Amount (estimated) required for completion of existing project,	57,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	57,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G G 2.)

3. Operating and care of Louisville and Portland Canal, Kentucky.—The canal was open to commerce throughout the year except on 71 days, during which it was closed because of high water or ice.

Traffic through it during the year comprised the passage of 3,784 boats with 537,464 tons of freight, 344,412 tons being coal.

The principal work done on the canal during the year, besides that relating to the passage of commerce, included dredging about 68,000 cubic yards from the canal, the erection of a new pair of middle gates in the locks, trimming dangerous projections from the side walls and underlying rock, the removal of some rock from the channel and approach to the lower lock, the completion of a new machine shop, boiler and engine house to replace those destroyed by fire during the winter of 1892, considerable repairs to the three bridges crossing the canal, repairs to dredges, steamboat, locks, and adjacent buildings, and building two new mud scows.

The cost of operating and care of the canal during the year was $69,348.74.

(See Appendix G G 3.)

4. Wabash River, Indiana and Illinois.—The improvement of this river by the General Government was undertaken in 1872. Since 1881 separate appropriations have been made for the portions of the river below Vincennes, Ind., and above that point.

a. Below Vincennes.—The principal work during the past year had for its object the construction of the dam at Grand Rapids, near Mount Carmel, Ill. Contract for supplying about 1,000,000 feet, B. M., of oak timber for the cribwork of the proposed structure, at a total cost of $22,407.84 was made, and its delivery is now in progress. About 10,000 cubic yards of stone required for filling the cribwork has been quarried and placed in convenient position for transfer into the dam. It is expected to complete the work during the ensuing low-water season. The snag boat *Osseo*, originally purchased in 1881 for operations on this river, was rebuilt during the year.

The completion of the dam will reëstablish navigation over the Grand Rapids, which has heretofore been an insuperable obstacle, except during periods of high water. But low-water navigation from that place to the mouth of the river will remain impossible until extensive repairs are made to the works heretofore built on that section, and which have now become almost useless because of damage by ice and freshets. Ten thousand dollars is required to dredge the approaches to the new lock at Grand Rapids and to construct wing walls leading thereto and below.

The total expenditure for improving this section of the river from 1872 to June 30, 1893, including liabilities outstanding, was $643,824.33.

July 1, 1892, balance unexpended		$6,914.41
Amount appropriated by act approved July 13, 1892		60,000.00
		66,914.41
June 30, 1893, amount expended during fiscal year		21,746.62
July 1, 1893, balance unexpended		45,167.79
July 1, 1893, outstanding liabilities	$584.28	
July 1, 1893, amount covered by uncompleted contracts	22,407.84	
		22,992.12
July 1, 1893, balance available		22,175.67

Amount (estimated) required for completion of existing project	$40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

b. Above Vincennes.—The snag boat *Richard Ford* was at work on this portion of the river from August 11 to the end of December, 1892. The channel was cleared of the most dangerous snags in about one-half of the distance from Vincennes, Ind., to Terre Haute, Ind., 688 snags, with a total weight of about 3,870 tons, being removed and cut up in this work. During the ensuing year it is proposed to resume the work at the first opportunity and clear the balance of the channel up to Terre Haute.

The amount expended on this section of the river to June 30, 1893, was $78,237.66.

July 1, 1892, balance unexpended	$4,767.98
Amount appropriated by act approved July 13, 1892	5,000.00
	9,767.98
June 30, 1893, amount expended during fiscal year	7,505.64
July 1, 1893, balance unexpended	2,262.34
July 1, 1893, outstanding liabilities	6.85
July 1, 1893, balance available	2,255.49

Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G G 4.)

5. White River, Indiana.—The object of this improvement is to make the river navigable for the transportation of local products at all stages, by removing rocky reefs and gravel shoals, contracting the wider portions by dams or dikes, and removing snags. With sufficient money a navigable low-water channel, with a depth of 2 feet, might be realized. Operations during the past year were limited to the removal of snags, and it is proposed to continue such work during the summer and fall of 1893. When this has been done all the dams heretofore built on the river should be repaired and channels that had been made through bars and shoals should be re-dredged, in order to restore the river to the condition in which it was prior to the suspension of operations, as directed by Congress in the act of August 11, 1888.

The amount expended on this river to June 30, 1893, was $104,812.94.

July 1, 1892, balance unexpended	$2,954.79
Amount appropriated by act approved July 13, 1892	5,000.00
	7,954.79
June 30, 1893, amount expended during fiscal year	262.98
July 1, 1893, balance unexpended	7,691.81
July 1, 1893, outstanding liabilities	803.07
July 1, 1893, balance available	6,888.74

Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	7,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix G G 5.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. G. J. Lydecker, Corps of Engineers, and reports thereon submitted:

1. Little Wabash River, Illinois.—Lieut. Col. Lydecker submitted report of examination under date of December 22, 1892. It is his opinion, concurred in by this office, that the river is not at this time worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 163, Fifty-second Congress, second session. (See also Appendix G G 6.)

2. Embarras River, Illinois.—Lieut. Col. Lydecker submitted report of examination under date of December 22, 1892. It is his opinion, concurred in by this office, that the river is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 162, Fifty-second Congress, second session. (See also Appendix G G 7.)

IMPROVEMENT OF GREAT KANAWHA, ELK, AND GAULEY RIVERS, WEST VIRGINIA, AND OF NEW RIVER, VIRGINIA AND WEST VIRGINIA.

This district was in the charge of Col. William P. Craighill, Corps of Engineers.

1. Great Kanawha River, West Virginia.—This river flows through a fertile and picturesque region, filled with mineral wealth, especially coal and salt. It was by nature divided into a number of pools, some of considerable length and depth, separated by shoals of gravel and coarse sand, which were the principal obstructions to navigation in low water, there being often on them at such seasons but a few inches of water. In some of the pools were found shallow places, also obstructing navigation. There were also snags and loose rocks in the channel. The navigation was almost suspended in summer.

The coal and salt were generally sent out on rises, which enabled the boats to pass safely over the obstructions that otherwise would stop their movements entirely. The use of the river for the movement of these valuable products was therefore unsatisfactory and intermittent. By the agency and superintendence of a board acting under the State, first of Virginia and then of West Virginia, considerable improvement in the river was from time to time effected, tolls being charged on the commerce for the payment of expenses.

The object of the improvement, begun several years ago by the United States, was to give a constant navigable depth of at least 6 feet throughout the whole length of the Kanawha to its mouth at the Ohio River, to be accomplished by large locks and dams.

Those already built have been about 300 by 50 feet above Charleston and about 340 by 55 below.

The peculiarity of most of the dams is that they can be lowered when the stage of the water in the river will suffice over the shoals. This gives them the name of "movable dams," and enables an open river to be had when the water is high enough.

Dams 3 and 2, above Paint Creek, are fixed, as the declivity of the river in that section is too great to permit the advantageous use of the movable system.

Up to June 30, 1892, the amount expended was $2,389,302.03. At that date the finished works were Locks and Dams 2, 3, 4, 5, and 6.

An appropriation of $225,000 was made July 13, 1892, and another of $500,000 March 3, 1893.

The following list of contracts indicates in a summary way the principal work in progress during the fiscal year.

Contract with Munford & Reynolds, dated December 29, 1890, for the foundations of Dam No. 7, or the immovable parts of the navigation pass and weir, and of a central pier and an abutment with shore crib and bank protection, completed June 1, 1803.

Contract with C. Irwin McDonald, dated March 3, 1891, for the foundations of Dam No. 8 or immovable parts of the navigation pass and weir, and of a central pier and an abutment with shore crib and bank protection, completed in May, 1893.

Contract with The Fred. J. Meyers Manufacturing Company, dated June 8, 1892, for irons for the movable parts of Dams Nos. 7 and 8, including the maneuvering winches, and some extra irons for Dams Nos. 4, 5, and 6, to be completed September 1, 1893.

Contract with H. T. Morrison & Co., dated November 19, 1892, for iron work for the gates of Locks 7 and 8, to be completed July 20, 1893.

Contract with James M. Mays, dated March 31, 1893, to build two lock houses, one at the site of Lock No. 9 and one at the site of Lock No. 10, with outhouses at each, to be completed August 10, 1893.

Contract with L. Williams, dated April 17, 1893, for building one dump boat, to be completed July 15, 1893.

Contract with the West End Rolling Mill Company, limited, and Chain Works, dated April 20, 1893, for chains and clevises for Dams Nos. 7 and 8, to be completed July 15, 1893.

Contract with Zimmerman, Truax & Sheridan, dated May 23, 1893, for building Lock and Dam No. 9, to be completed December 31, 1896.

Contract with Thomas Munford, dated June 1, 1893, for building Lock and Dam No. 11, to be completed December 31, 1896.

Contract with Zimmerman, Truax & Sheridan, dated June 5, 1893, for building Lock and Dam No. 10, to be completed December 31, 1896.

The amount expended in the year ending June 30, 1893, exclusive of outstanding liabilities, was $201,923.26.

Had funds been available, all the locks and dams needed for this improvement could have been begun at the same time and finished in three years with much economy to the United States and with manifest advantage in the use of the improved waterway. The development of commerce on this river has been very great since the improvement by the United States, although the project has as yet been only partially executed for want of money.

During the seasons of low water the value of the improvement is shown in a very marked manner, as free and sufficient navigation is then easily maintained over the improved part of the river, while navigation may be entirely suspended below the lowest dam and above the upper pool.

The estimate for the project for the improvement of the Great Kanawha River, by the method of locks and movable dams, was prepared in 1875.

The river and harbor act of July 13, 1892, contained the following provision:

Provided, That such contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the revised project of improvement of January eighth, eighteen hundred and ninety-two, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one million eighty thousand seven hundred dollars, exclusive of the amounts herein and heretofore appropriated.

In compliance with this law contracts have been made for the completion of the remaining locks and dams, 9, 10, and 11.

Locks and Dams 7 and 8 are nearly ready for use and will be in operation before the end of the calendar year 1893, thus adding 18 miles to the improved portion of the river.

No appropriation is asked for this river for the fiscal year ending June 30, 1895, as work has been so much delayed it is believed the money already available will suffice for that fiscal year. Some of the reasons are the following: Congress by act of July 13, 1892, provided for the completion of the improvement fixing a certain sum for the purpose, based upon an estimate made before the passage of the eight-hour law. It has since been difficult to get reliable contractors to take the work within the limit. Delay has also been caused by the necessity of resorting to the tedious process of condemnation in procuring the land at new sites for locks and dams. The sites are, however, all now in the possession of the United States and good contracts are made for completing the remaining locks and dams.

July 1, 1892, balance unexpended		$207,900.02
Amount appropriated by act approved July 13, 1892		225,000.00
Amount appropriated by sundry civil act approved March 3, 1893		500,000.00
		932,900.02
June 30, 1893, amount expended during fiscal year		201,923.26
July 1, 1893, balance unexpended		730,976.76
July 1, 1893, outstanding liabilities	$4,000.00	
July 1, 1893, amount covered by uncompleted contracts	1,078,742.04	
		1,082,742.04
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		580,700.00

(See Appendix H H 1.)

2. Operating and care of locks and dams on Great Kanawha River, West Virginia.—The amount expended during the fiscal year ending June 30, 1893, for this purpose was $19,564.91. (See Appendix H H 2.)

3. Elk River, West Virginia.—The Elk is one of the chief tributaries of the Great Kanawha, emptying into it at Charleston. Its course is tortuous, but the country through which it flows is rich in minerals and well fitted for agriculture and grazing.

The average low-water width is about 200 feet, with narrows at the rapids of about 150 feet in width and occasional portions of about 300 feet in width. The pools vary in depth from 3 to 10 feet, and are separated by rapids over shoals of cobblestones and gravel, on which there has been at low seasons a depth of but a few inches of water. The average fall per mile in the river from Braxton down is about 2½ feet, but is not uniformly distributed, being greatest (about 4 feet per mile) in the central section and less (about 2 feet) in the upper and lower sections. Freshets of small height are of frequent occurrence, but rapidly pass off. The annual rise in the spring is about 10 or 12 feet. An extraordinary rise is sometimes had of 25 to 30 feet, but the duration is not great.

The approved project of improvement has been the removal of rocks, snags, overhanging trees, etc., and the making of narrow sluices through the rapids and shoals. The principal interests to be served are those of lumbering and rafting, but much country produce is also carried downstream in small boats, which return with merchandise, etc.

The work done was between Little Otter, 6 miles below Sutton, and Mink Shoals, 4 miles from the mouth of the river, embracing a distance of about 90 miles. It consisted mainly in clearing and widening the chutes and in building, altering, and repairing chute walls on the shoals. A passage for rafts was also made through four old and abandoned mill dams, a break in the Blue Creek Dam was repaired, and where required snags, leaning trees, and like obstructions were removed. The work was done between August 10 and October 27, 1892, with a force of hired laborers under the overseer employed on this part of the river last year.

A serious obstruction to the navigation of this river at some stages consists of several other milldams. The attention of the proper authorities has been called to these in compliance with the law.

July 1, 1892, balance unexpended	$158.89
Amount appropriated by act approved July 13, 1892	2,500.00
	2,658.89
June 30, 1893, amount expended during fiscal year	2,574.19
July 1, 1893, balance unexpended	84.70
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	3,000.00

(See Appendix H H 3.)

4. Gauley River, West Virginia.—Gauley River takes its rise in Webster County, W. Va., its tributaries having their sources in Pocahontas and Greenbrier counties. It is about 115 miles in length, flowing through Nicholas and Fayette counties in a southwesterly direction, sometimes nearly west, and near its mouth almost due south; it is entirely in the State of West Virginia. Its headwaters and those of its tributaries are covered with a virgin forest of the finest timber, with only clearings of a few acres here and there; and on the north side of the river, in Webster and Nicholas counties, some glades a few miles wide and in extent 20 or 25 miles, which give only a stunted growth, to break up this vast timber section.

For the first 12 miles from its mouth the Gauley falls only 4 feet per mile; in the next 26 miles its fall is nearly 34 feet per mile, in a gorge similar to that of New River, as seen from the Chesapeake and Ohio Railway between Kanawha Falls and Hinton, the hills on either side being several hundred feet high and almost perpendicular, and the stream full of bowlders of sandstone, some very large, and so numerous as to justify the people in calling this section the "Roughs" of Gauley. From the head of the "Roughs" near Hominy Creek, 2 miles above Hughes Ferry, to the Forks, about 57 miles, the fall is estimated at 5 feet per mile. The levels from the mouth of Gauley River to the mouth of Meadow River, 29 miles, are taken from Ellet's report on the Great Kanawha River, West Virginia, made in 1858; the remainder are estimated. The levels on Meadow River were obtained from the same source.

Gauley River is 500 feet wide at its mouth, 350 feet wide at mouth of Meadow River, 200 feet wide at mouth of Cranberry River, 150 feet wide at mouth of Williams River, and 75 feet wide at the Forks.

Operations for the improvement of the Gauley River were instituted after an examination made in 1878 in accordance with the provisions of the river and harbor act of August 5, 1886. It was then pointed out that a valuable improvement of the 12 miles of river from the mouth to

the "Roughs" could be made at an expense of $10,000, and that a great advantage would follow the expenditure of $65,000 in the 26-mile reach called the "Roughs" in facilitating and cheapening the bringing to market of millions of feet of lumber of the most valuable and varied kinds.

The approved project has consisted in the removal of ledges and loose rocks and the making of channels through shoals of loose rock and bowlders from the mouth of the river to the "Roughs" to improve the navigation for boats and rafts, and in blasting down the very large bowlders in the "Roughs" to permit the more free passage of logs. The amount expended to the close of the fiscal year ending June 30, 1892, was $5,737.32, with decided advantage to the navigation over the worst shoals below the "Roughs."

The amount expended in the fiscal year ending June 30, 1893, has been $2,964.80.

The work was commenced in July, 1892, and was closed in October. The portion of the river included in the operations was from the mouth to the "Roughs." Its navigable condition has been thereby decidedly improved to obtain a depth of 2 feet at ordinary low water. In the season of 1892 the water was exceptionally low.

The Kanawha and Michigan Railroad Company have practically completed their bridge over this river near the mouth, as have also the Chesapeake and Ohio Company their bridge over the river 5 miles above the mouth.

July 1, 1892, balance unexpended	$82.68
Amount appropriated by act approved July 13, 1892	3,000.00
	3,082.68
June 30, 1893, amount expended during fiscal year	2,964.80
July 1, 1893, balance unexpended	117.88

Amount (estimated) required for completion of existing project	66,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix H H 4.)

5. New River, Virginia and West Virginia.—The last appropriation was that of August 5, 1886, of which a balance remains of $2,341.79.

In compliance with a recommendation of the local engineer, it was decided by the Secretary of War not to expend the existing balance at present.

There were no operations or expenditures in the year ending June 30, 1893.

The Chesapeake and Ohio Railroad has constructed a bridge over the unnavigable portion of this river not far above its junction with the Gauley.

July 1, 1892, balance unexpended	$2,341.79
July 1, 1893, balance unexpended	2,341.79

Amount (estimated) required for completion of existing project	159,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix H H 5.)

IMPROVEMENT OF CERTAIN RIVERS IN KENTUCKY AND WEST VIRGINIA.

This district was in the charge of Maj. D. W. Lockwood, Corps of Engineers, having under his immediate orders Lieut. W. L. Sibert, Corps of Engineers, to August 18, 1892; Lieut. James J. Meyler, Corps of Engineers, since October 19, 1892, and Lieut. H. E. Waterman, Corps of Engineers, since May 10, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Tradewater River, Kentucky.—This river was practically closed before the work of improvement commenced, by a rock bar near its mouth, and, higher up, by logs, snags, drift piles, leaning trees, and bars.

The present project, adopted in 1881, provides for clearing the river and its banks of obstructions and opening up a channel 40 feet wide and 2½ feet deep during six months of the year, the improvement to extend 41 miles upstream from its mouth in the Ohio.

Up to June 30, 1892, $15,592.90 had been expended, resulting in securing a channel through the rock bar near the mouth of the river, and in removing obstructions in the channel and on the banks of the river for a distance of 41 miles, the distance covered by the present project.

During the fiscal year ending June 30, 1893, no field work was done, the amount expended, $145.75, being for care of property and incidentals.

July 1, 1892, balance unexpended	$907.10
June 30, 1893, amount expended during fiscal year	145.75
July 1, 1893, balance unexpended	761.35

(See Appendix I I 1.)

2. Lock No. 2, Green River, at Rumsey, Ky.—The deficiency act approved March 3, 1893, appropriated $65,000 for rebuilding this lock, which in 1892 was reported unsafe for navigation.

The project for this work, approved in 1893, calls for the construction of a new lock on the river side of the old lock, with certain changes of existing conditions to make them conform to location of lock.

The amount expended to June 30, 1893, was $1,645.39, and resulted in the commencement of the auxiliary dam and preparations for the general work.

Amount appropriated by deficiency act approved March 3, 1893		$65,000.00
June 30, 1893, amount expended during fiscal year		1,645.39
July 1, 1893, balance unexpended		63,354.61
July 1, 1893, outstanding liabilities	$1,176.42	
July 1, 1893, amount covered by uncompleted contracts	27,086.28	
		28,262.70
July 1, 1893, balance available		35,091.91

Amount (estimated) required for completion of existing project	105,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	105,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 2.)

3. Green River above mouth of Big Barren River, Kentucky.—In pursuance of the provisions of act of September 19, 1890, an examination was made of this portion of Green River, and the report thereon, with

project for the work proposed, was submitted to Congress as Appendix J J 15, Annual Report, Chief of Engineers, 1891. The improvement proposed contemplated the construction of two locks and dams, so as to extend slackwater navigation to Mammoth Cave, at an estimated cost of $361,346.40.

The river and harbor act of July 13, 1892, appropriated $50,000 towards the construction of Lock No. 5, the project for which provides for the location and construction of a lock and dam at the head of slackwater navigation on the river.

The amount expended to June 30, 1893, was $596.02, and resulted in a contingent selection of site near Honakers Ferry, about 12 miles above the mouth of Big Barren River.

Amount appropriated by act approved July 13, 1892	$50,000.00
June 30, 1893, amount expended during fiscal year	596.02
July 1, 1893, balance unexpended	49,403.98
Amount (estimated) required for completion of existing project	130,673.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	130,673.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 3.)

4. Operating and care of locks and dams on Green and Barren rivers, Kentucky.—When the United States acquired possession of these improvements, December 11, 1888, navigation of the system was broken at Lock No. 3, Green River, the river wall of that lock having fallen into the river, the lower end of the land wall at No. 1, Barren, was badly cracked, and liable to fall at any time, and both walls of No. 2, Green River, were in a dangerous condition. The channel of the river was much obstructed by snags and slides.

The operations up to June 30, 1892, resulted in the rebuilding of the old river wall at Lock No. 3; the taking down and reconstruction of the lower half of the river wall at No. 1, Barren; the rebuilding of dams No. 1, Barren, and No. 3, Green, from the crest to foot of lower slope; the raising of lock wall at No. 1, Green; the building of guide cribs at Nos. 1, 3, and 4, Green, and No. 1, Barren; grading and paving behind the lock walls at the different locks, with the exception of No. 2, Green; and the building of seven lock-keepers' houses; also in the construction of a snag boat, dredge boat, and various barges and derrick boats required in the prosecution of the work.

During the fiscal year ending June 30, 1893, $48,968.36 was expended, and resulted in general repairs to locks and dams, grading and paving lock grounds, construction and extension of guide and protection cribs, removal of snags, and dredging of lock entrances.

Navigation was temporarily suspended at Lock No. 2, Green, except for barges and rafts, on account of the dangerous condition of the walls. At present, crafts of every kind are permitted to go through the lock, but no person is allowed on them during transit.

(See Appendix I I 4.)

5. Rough River, Kentucky.—This river was originally very much obstructed by overhanging trees on the banks, and by snags, logs, etc., in the bed of the river. The lower 8 miles of the stream is affected by backwater from the Rumsey Dam (No. 2) on Green River, but above this point the stream has but little depth at low water.

The project for the improvement, adopted in 1890, is to clear the river of obstructions, to wit, overhanging trees on the banks, and

snags, logs, and stumps in the bed of the river, and to locate and construct a lock and dam near the site of the old ones to carry slack water to Hartford.

The amount of money expended to June 30, 1892, was $5,832.04, and resulted in a survey for the site of lock and preparing plans for the lock, dam, etc.; the removal of obstructions throughout the length of the stream from its mouth to Hartford, in the river, and the deadening of trees on the banks for the same distance.

The amount expended during the fiscal year ending June 30, 1893, was $1,187.94, and resulted in the purchasing of the necessary lands at the lock site, the running of a line of levels from Lock No. 2 to the site of the proposed lock, and in the preparation of plans for the lock and dam.

July 1, 1892, balance unexpended		$19,167.96
Amount appropriated by act approved July 13, 1892		15,000.00
		34,167.96
June 30, 1893, amount expended during fiscal year		1,187.94
July 1, 1893, balance unexpended		32,980.02
July 1, 1893, outstanding liabilities		430.85
July 1, 1893, balance available		32,549.17
Amount (estimated) required for completion of existing project		65,556.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		65,556.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I I 5.)

6. Kentucky River, Kentucky.—The condition of the river when the United States assumed charge of its improvements was as follows: The five locks and dams with their approaches, built by the State of Kentucky, were in a dilapidated condition, and the channel was much obstructed by snags and leaning trees.

The project for the improvement, adopted in 1879, called for the necessary repairs to the five locks and dams, and the extension of slack-water navigation for a draft of 6 feet, by the construction of additional locks and dams to Beattyville, a distance of 261 miles from the mouth of the river.

Up to the close of the fiscal year ending June 30, 1892, $1,344,017.84 had been expended, resulting in the restoring of the locks and dams to a navigable condition, clearing the channel and banks of obstructions, and the partial completion of a new lock, known as No. 6 of the system.

The amount expended during the fiscal year ending June 30, 1893, was $47,584.49, and resulted in continuing the work at Lock and Dam No. 6, and in examinations for the location of Lock No. 7, near Twin Ripple.

July 1, 1892, balance unexpended		$3,982.16
Amount appropriated by act approved July 13, 1892		150,000.00
		153,982.16
June 30, 1893, amount expended during fiscal year		47,584.49
July 1, 1893, balance unexpended		106,397.67
July 1, 1893, outstanding liabilities	$3,337.01	
July 1, 1893, amount covered by uncompleted contracts	17,240.00	
		20,577.01
July 1, 1893, balance available		85,820.66

Amount (estimated) required for completion of existing project	$1,524,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 6.)

7. Operating and care of locks and dams on Kentucky River, Kentucky.—The first allotment for this work was for the fiscal year ending June 30, 1885, at which time only four locks could be operated; these required extensive repairs at the time, and the dams and approaches were in a more or less dilapidated condition.

The operations up to June 30, 1892, resulted in reopening Lock No. 5 to navigation and placing the other locks and dams in a serviceable condition, the building of guide walls, approaches, the construction of one double and seven single lock houses, and in grading, paving, and draining grounds about the locks. A new dredge boat, of the Osgood pattern, and two dump scows have been constructed, and general repairs made to locks, dams, etc., and, in addition, the river has been kept clear of snags. A stone abutment to Dam No. 2 has been constructed, and the lock entrances kept clear by dredging.

The amount expended during the fiscal year ending June 30, 1893, was $46,429.08, and resulted in the removal of rocks, snags, logs, etc.

(See Appendix I I 7.)

8. Licking River, Kentucky, between Farmers and West Liberty.—This stream was originally much obstructed by logs, snags, rocks, and leaning trees, as well as by fish dams constructed by private parties.

The project for the improvement was adopted in 1888, and provides for removing rocks, snags, and bowlders from the river bed.

The amount expended to June 30, 1892, was $5,792.56, and resulted in the removal from the bed of the river of a large number of rocks, snags, etc., that obstructed both rafting and low-water navigation.

July 1, 1892, balance unexpended	$207.44
June 30, 1893, amount expended during fiscal year	207.44

Amount (estimated) required for completion of existing project	11,680.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 8.)

9. Big Sandy River, West Virginia and Kentucky.—When the United States commenced improving this stream it and its forks were much obstructed by rocks, bars, snags, and leaning trees. During low-water seasons navigation was practically suspended.

The present project was adopted in 1878, and provided for improving the push-boat and rafting facilities of the river and forks by removing obstructions, etc. This was modified in 1880 to secure slackwater navigation by the construction of a test lock and dam near Louisa, Ky.

The amount expended to June 30, 1892, was $243,892.13, and resulted in improving low-water navigation by the removal of rocks, stumps, snags, and logs from the channel, and leaning trees from the banks of the river, and in the construction of a lock complete near Louisa, also in the construction of about 80 feet of a permanent dam, and the purchase of timber for the completion of same.

The amount expended during the fiscal year ending June 30, 1893, was $37,960.41, and resulted in modifying the lock to suit the change from a fixed to a movable dam; the deepening of the entrances to the

lock; the construction of shore cribs above and below the lock; the protection of the Kentucky bank by riprap, and in the partial construction of a cofferdam to inclose the site of the pass and pier of the movable dam.

July 1, 1892, balance unexpended		$16,107.87
Amount appropriated by act approved July 13, 1892		50,000.00
		66,107.87
June 30, 1893, amount expended during fiscal year		37,960.41
July 1, 1893, balance unexpended		28,147.46
July 1, 1893, outstanding liabilities	$4,944.91	
July 1, 1893, amount covered by uncompleted contracts	2,964.50	
		7,909.41
July 1, 1893, balance available		20,238.05
Amount (estimated) required for completion of existing project		28,029.25
Amount that can be profitably expended in fiscal year ending June 30, 1895		28,029.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix I I 9.)

10. Levisa Fork of Big Sandy River, Kentucky.—This stream was originally much obstructed by rocks, snags, logs, and overhanging trees. Its improvement has been in progress since work on the Big Sandy was commenced under the project for the improvement of that stream.

The present project was adopted in 1890, and provides for the removal of snags, logs, stumps, rocks, etc., from the river, and overhanging trees on the banks.

The amount expended to June 30, 1892, was $20,730.14, and resulted in the material improvement of navigation, by the removal of obstructions, giving increased facilities for push-boat navigation at low water, and rafting and light-draft steamboat navigation at moderate stages.

The amount expended during the fiscal year ending June 30, 1893, was $1,645.96, and resulted in the further removal of snags, rocks, logs, and stumps from the river bed.

July 1, 1892, balance unexpended	$19.86
Amount appropriated by act approved July 13, 1892	2,500.00
	2,519.86
June 30, 1893, amount expended during fiscal year	1,645.96
July 1, 1893, balance unexpended	873.90
July 1, 1893, outstanding liabilities	301.08
July 1, 1893, balance available	572.82
Amount that can be profitably expended in fiscal year ending June 30, 1895	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix I I 10.)

11. Tug Fork of Big Sandy River, West Virginia and Kentucky.—This stream was originally much obstructed by rocks, snags, logs, and overhanging trees. Its improvement has been in progress since work on the Big Sandy was commenced on the project for the improvement of that stream.

The present project was adopted in 1890, and provides for the removal of snags, logs, stumps, rocks, etc., from the river, and overhanging trees from the banks.

The amount expended to June 30, 1892, was $20,598.66, and has resulted in the material improvement of navigation, giving increased facilities for push boats at low water, and rafting and light-draft steamboats at moderate stages.

The improvement has been carried to a point 100 miles above Louisa.

The amount expended during the fiscal year ending June 30, 1893, was $1,818.33, and resulted in the general improvement of the lower part of the stream. The upper 22 miles, improved, has been very much obstructed in recent years by the construction of the Norfolk and Western Railroad, rocks, stumps, and trees having been blasted and thrown into the stream in preparing the roadbed of that road. It is claimed by the railroad people that these obstructions have been removed, but this fact can only be determined by an examination at low water.

July 1, 1892, balance unexpended	$151.34
Amount appropriated by act approved July 13, 1892	2,500.00
	2,651.34
June 30, 1893, amount expended during fiscal year	1,818.33
July 1, 1893, balance unexpended	833.01
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,500.00

(See Appendix I I 11.)

12. Guyandotte River, West Virginia.—This stream was originally much obstructed by snags, logs, leaning trees, the remains of old dams, and milldams owned by private parties, which required removal.

The project for the improvement was adopted in 1878, and provided for the removal of existing obstructions, natural and artificial, so as to form a channel 30 feet wide, with a least depth of 18 inches, during five months of the year, and extending up the river a distance of 122 miles from the Ohio.

Up to the close of the fiscal year ending June 30, 1892, $16,406.30 had been expended, resulting in the partial improvement of the river for a distance of 119 miles, removing snags, logs, etc., from the channel, and cutting passageways through old dams.

During the fiscal year ending June 30, 1893, $2,039.34 was expended, and resulted in the general improvement of the stream for rafting purposes and low-water steamboat navigation.

July 1, 1892, balance unexpended	$93.70
Amount appropriated by act approved July 13, 1892	2,000.00
	2,093.70
June 30, 1893, amount expended during fiscal year	2,039.34
July 1, 1893, balance unexpended	54.36
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,000.00

(See Appendix I I 12.)

13. Little Kanawha River, West Virginia.—This river, at the time improvements were commenced by the United States, was much obstructed by logs, snags, leaning trees, etc., above that portion controlled by the Little Kanawha Navigation Company.

The original project, adopted in 1876, was for the removal of Beaver and Nailor Bend rocks, and for cleaning out snags and fallen trees.

This was modified in 1880 by the adoption of an additional project for the construction of a lock and dam 2 miles above Burning Springs, W. Va.

Up to June 30, 1892, $207,665.60 had been expended, resulting in placing the upper part of the river in a fair rafting condition, and so that, during moderate stages, light-draft steamboats could run as far as Grantsville. The lock and dam 2 miles above Burning Springs have been completed, a lock-house built, grounds graded and fenced, and slack-water navigation opened up for an additional distance of 9 miles.

During the fiscal year ending June 30, 1893, $3,246.23 was expended, and resulted in completing the dam and guide cribs above and below the lock, paving behind the land wall of the lock, and protection of the river bank below.

July 1, 1892, balance unexpended	$3,509.40
July 30, 1893, amount expended during fiscal year	3,246.23
July 1, 1893, balance unexpended	263.17
July 1, 1893, outstanding liabilities	158.85
July 1, 1893, balance available	104.32

(See Appendix I I 13.)

14. Operating and care of lock and dam on Little Kanawha River, West Virginia.—The lock was opened to navigation December 2, 1891, and has been operated continuously, with the exception of a short time in June, 1892, when it was closed temporarily for repairs.

During the last fiscal year there were times when, owing to the leaking of the dam of the navigation company next below, the lower miter sill was out of water.

The amount expended during the fiscal year ending June 30, 1893, was $4,797.97, applied to operating the lock and making general repairs to lock, dam, and lock walls.

(See Appendix I I 14.)

15. Buckhannon River, West Virginia.—This stream was originally so obstructed by rocks and log jams that timber could be floated out only on a 12-foot rise.

The project for its improvement, adopted in 1884, provides for the formation of a rafting channel 24½ miles long with a minimum width of 30 feet.

The amount expended to June 30, 1892, was $5,482.78, and resulted in the general improvement of the stream, so as to make it available for rafting at a much lower stage than was possible formerly.

The amount expended during the fiscal year ending June 30, 1893, was $17.22, applied to incidental expenses.

July 1, 1892, balance unexpended	$17.22
June 30, 1893, amount expended during fiscal year	17.22

(See Appendix I I 15.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. D. W. Lockwood, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. Licking River, Kentucky, with a view to providing slack-water navigation.—Maj. Lockwood submitted report of examination under date

of October 17, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government in the manner proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 57, Fifty-second Congress, second session. (See also Appendix I I 16.)

2. Big Sandy River, Kentucky, from its junction with the Ohio River to the crossing of the Big Sandy by the Chesapeake and Ohio Railroad Bridge, with a view of ascertaining if there be a bar in the Ohio River at the mouth of said Big Sandy obstructing navigation, and, if there be, whether by confining the waters of the Big Sandy to the general course of its channel between said points the said bar will be removed.—Maj. Lockwood submitted report of examination under date of October 18, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 66, Fifty-second Congress, second session. (See also Appendix I I 17.)

LAKE HARBORS AND RIVERS.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

This district was in the charge of Capt. W. L. Fisk, Corps of Engineers, to October 10, 1892, and of Maj. Clinton B. Sears, Corps of Engineers, since that date; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Harbor at Grand Marais, Minn.—This small natural basin was not originally of sufficient depth nor was it adequately sheltered either for commercial purposes or for use as a harbor of refuge; the approved project of 1879, therefore, proposed two breakwater piers each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and the dredging to a depth of at least 16 feet of an anchorage area of about 26 acres at a total estimated cost of $139,669.40. Up to the close of the fiscal year ending June 30, 1892, there had been expended on this work $115,883.71; with this sum 350 feet of the east pier had been completed and the 16-foot anchorage area increased to 21.5 acres.

Under the present contract, work to commence July 1, 1893, for dredging, this anchorage area will be still further increased to 25 acres. The completion of this contract will practically exhaust the appropriation.

July 1, 1892, balance unexpended	$1,466.29
Amount appropriated by act approved July 13, 1892	10,000.00
	11,466.29
June 30, 1893, amount expended during fiscal year	586.47
July 1, 1893, balance unexpended	10,879.82
July 1, 1893, amount covered by uncompleted contracts	9,000.00
July 1, 1893, balance available	1,879.82
Amount (estimated) required for completion of existing project	12,319.40
Amount that can be profitably expended in fiscal year ending June 30, 1895	12,319.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 1.)

2. Harbor at Agate Bay, Minnesota.—This is a shipping port for iron ore, and when the breakwater piers are built will form a harbor of refuge. It is 27 miles east of Duluth.

amount expended to June 30, 1892, was $61,884.58; amount ex-
l during fiscal year ending June 30, 1893, $726.99.

1892, balance unexpended		$1,115.41
appropriated by act approved July 13, 1892		30,000.00
		31,115.41
1893, amount expended during fiscal year		726.99
1893, balance unexpended		30,388.42
1893, outstanding liabilities	$5,410.00	
1893, amount covered by uncompleted contracts	21,590.00	
		27,000.00
1893, balance available		3,388.42
nt (estimated) required for completion of existing project		151,708.00
nt that can be profitably expended in fiscal year ending June 30, 1895		151,708.00

tted in compliance with requirements of sections 2 of river and
or acts of 1866 and 1867, and of sundry civil act of March 3, 1893.
Appendix J J 2.)

arbor at Duluth, Minn.—The original project for the improve-
of the harbor, adopted in 1871, consisted of a breakwtaer in
Superior outside of Minnesota Point in continuation of one al-
commenced by the Northern Pacific Railroad Company. This
rater was destroyed by a storm in 1872 and abandoned. In 1873
ss provided for maintaining the canal through Minnesota Point,
had been constructed by the city of Duluth, and for dredging
ls in Superior Bay to the Duluth docks.
k under this project was continued until 1881, at which time the
f the canal had been repaired and somewhat extended, a harbor
lredged of moderate capacity, and a narrow channel dredged in
or Bay from Duluth to deep water at Connor Point. The amount
led under this project was $270,651.81.
present project was adopted in 1881 and modified in 1884 and
he object being to preserve the piers bordering the canal, dredg-

the dredged area of the harbor basin to about 104 acres, exclusive of private dredging, removing shoals from area previously dredged, giving the whole dredged basin a minimum depth of 16 feet, maintaining the canal piers, and making narrow 16-foot channels east of Rice Point and on north shore of St. Louis Bay.

Work during the past year consisted in enlarging the channel along the east side of Rice Point and on the north side of St. Louis Bay. This gives the former a uniform width of 200 feet with a greater width at the bend, and wide, flaring entrances at each end. The current work on the latter channel is expected to widen it from the present 100 feet to 160 feet throughout its length to Grassy Point.

The work contracted for under the current appropriation to improve the St. Louis River above Grassy Point is expected to give in that river a continuous navigable channel up to Ironton, having a least depth of 16 feet and a minimum width of 90 feet, with long reaches of greater width and depth.

The canal piers are in a poor condition, and the entire work needs to be replaced with an improved and permanent structure.

The harbor basin and connecting channels will eventually require deepening to 22 feet. The channels recently commenced should be completed at an early date, both for the accommodation of commerce and as a matter of economy. The ruling depths in the portions of the harbor dredged by the United States are:

	Feet.
In canal	17
In the inner basin or harbor	16
In channel on north shore of St. Louis Bay for a distance of about 12,900 feet	16
In new channel east of Rice Point	16

In compliance with a requirement of the river and harbor act approved July 13, 1892, Maj. Sears made an investigation of the question of ownership of the ground on which are located the canal and canal entrances and piers in Duluth Harbor, with the view of determining if the title of the United States to the property is complete, and his report thereon, dated November 26, 1892, was submitted to the Secretary of War with the recommendations of this office December 3, 1892; the papers were transmitted to Congress and printed as House Ex. Doc. No. 122, Fifty-second Congress, second session.

Plans for a tunnel under the canal, proposed to be constructed by the city of Duluth, were approved by the Secretary of War April 26, 1893.

July 1, 1892, balance unexpended		$17,010.75
Amount appropriated by act approved July 13, 1892		125,000.00
		142,010.75
June 30, 1893, amount expended during fiscal year		51,166.34
July 1, 1893, balance unexpended		90,844.41
July 1, 1893, outstanding liabilities	$13,977.65	
July 1, 1893, amount covered by uncompleted contracts	60,852.13	
		74,829.78
July 1, 1893, balance available		16,014.63

Amount (estimated) required for completion of existing project	122,026.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	237,332.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 3.)

4. Harbor at Superior Bay and St. Louis Bay, Wisconsin.—Originally the natural entry to Superior Bay was obstructed with shifting bars

having at most but 9 feet depth of water over them. The citizens of Superior attempted to remedy this by constructing piers to confine the outflowing waters of the bay, and this work was taken up by the United States in 1867, and has successfully maintained since then a ruling depth of 16 feet between the piers.

The piers are 350 feet apart, and a good deal of dredging has been necessary to obtain the required depth between them and the channels leading to Connor Point and the Quebec Dock and a new connecting channel in St. Louis Bay. The original project of 1867 has, therefore, been modified from time to time to meet the needs of the rapidly increasing capacity of the vessels visiting this port, the last modification being made by act of Congress approved August 5, 1886, which added improvement of channel in St. Louis Bay.

In carrying out the original project with modifications there had been expended to June 30, 1892, the sum of $218,827.60.

Under existing contract for dredging to be completed November 1, 1893, it is expected the following results will be obtained:

A depth of 18 feet over a width of 300 feet in the entry between the piers; easing off the corners leading into and out of the Quebec Channel; opening new channel 16 feet deep and 100 feet wide, some 2,200 feet in a northerly direction from Quebec Dock, along west side of Superior Bay; increasing width of channel at Connors Point; widening and extending 16-foot channel in St. Louis Bay westward along West Superior dock line.

The length of this extension will be about 3,400 feet and its width 60 feet.

The entry piers need extensive repairs, particularly the superstructure. The entry and dredged channels have full 16 feet depth.

July 1, 1892, balance unexpended		$21,542.94
Amount appropriated by act approved July 13, 1892		70,000.00
		91,542.94
June 30, 1893, amount expended during fiscal year		3,476.26
July 1, 1893, balance unexpended		88,066.68
July 1, 1893, outstanding liabilities	$3,074.61	
July 1, 1893, amount covered by uncompleted contracts	59,930.49	
		63.005.10
July 1, 1893, balance available		25,061.58

Amount (estimated) required for completion of existing project	156,736.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	156,736.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 4.)

5. Minnesota Point, at Superior, Wis.—The object of this work is to protect the channel from the old entrance to Superior Bay from drifting sand and to prevent the lake from cutting through Minnesota Point into the bay at a low place known as "The Opening."

The project approved October 23, 1890, was for a double post-and-board fence, of a total length of 1,216 feet, filled in with brush and stone to catch the sand.

The fence was completed May 27, 1891, and is accomplishing the purpose for which it was built.

July 1, 1893, balance unexpended	$45.92
June 30, 1893, amount returned to Treasury during fiscal year	45.92

(See Appendix J J 5.)

6. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay or from the waves generated within the bay itself by storms.

The approved project is for the construction of a pile, slab, and rock breakwater, 8,000 feet long, northeast of the town, and for dredging a channel in front of the wharves of the city to accommodate vessels drawing 16 feet of water. During the season of 1889 a portion of the breakwater, 4,650 feet in length, was completed, but a severe storm in November the same year destroyed the outer 50 feet, and the slab filling settled in some places. During 1891, 1,080 feet was added to the breakwater, making its present length 5,680 feet, the breach in Chequamegon Point was closed with a brush and stone dike, and the old part of the breakwater repaired.

Under existing contract to be completed October 31, 1893, it is expected about 1,680 feet will be added to the breakwater.

No dredging has yet been done.

The amount expended during the year was $943.67.

The total amount expended under approved project to June 30, 1892, was $137,138.67.

The breakwater, though of insufficient length to give full protection to all the wharves of the city, has nevertheless had a marked influence in improving the tranquillity of the harbor.

July 1, 1892, balance unexpended		$5,361.33
Amount appropriated by act approved July 13, 1892		45,000.00
		50,361.33
June 30, 1893, amount expended during fiscal year		943.67
July 1, 1893, balance unexpended		49,417.66
July 1, 1893, outstanding liabilities	$4.50	
July 1, 1893, amount covered by uncompleted contracts	40,500.00	
		40,504.50
July 1, 1893, balance available		8,913.16

Amount (estimated) required for completion of existing project	119,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	119,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 6.)

7. Harbor at Ontonagon, Mich.—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers was adopted.

The west pier has reached a length of 2,675 feet, and is very nearly out to the 18-foot curve of depth, as proposed. But this curve has advanced in the meantime, owing to the very considerable volume of sand carried into the lake by the river, and since it appears probable that the advance of the bar will keep pace with the extension of the piers, unless a very considerable extension is made at once, it does not appear that economic considerations would justify any further extension of the piers at present. The east pier is 2,315 feet in length.

For a time it seems that better results will be secured after the piers are put in repair and the superstructures to outer cribs of west pier are finished by dredging across the bar after each spring freshet. The channel between the piers has kept a depth of over 12 feet. A dredged

channel through the bar and the remaining 150 feet of superstructure on the west pier were completed in 1891.

At the close of work in 1891 the channel was left with 16 feet of water in it, but the river has partially filled this up during last season's freshets, and an examination made in June, 1893, shows an available depth of only 13.5 feet clear through, and along the inner half of over 16 feet.

Under existing contract repairs to piers will be made during this season amounting to about $5,000. Some dredging will be done after the spring freshets.

The amount expended during the fiscal year just closed was $1,237.14. The total cost of the improvement to June 30, 1892, was $306,643.08.

July 1, 1892, balance unexpended	$1,456.92
Amount appropriated by act approved July 13, 1892	20,000.00
	21,456.92
June 30, 1893, amount expended during fiscal year	1,237.14
July 1, 1893, balance unexpended	20,219.78
July 1, 1893, amount covered by uncompleted contracts	4,499.60
July 1, 1893, balance available	15,720.18
Amount (estimated) required for completion of existing project	33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	33,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 7.)

8. Eagle Harbor, Michigan.—Previous to the improvement of Eagle Harbor the entrance was obstructed by a rocky reef, with 8½ feet of water over the shoalest part.

The project for the improvement of this harbor was adopted in 1866 and modified in 1868, 1874, and 1878. The plan as finally carried out consisted in blasting and dredging through the rocky ledge a channel 130 feet wide and 14 feet deep, marking it with two guiding cribs, one on each side of the channel, and the removal of a number of bowlders.

The amount expended to the close of the fiscal year ending June 30, 1893, was $94,713.67, and has resulted in carrying out the above project, the work having been completed in 1879 and meeting the present demands of commerce.

No appropriation is asked for this harbor, as the funds available will probably be sufficient to keep the work in good order for several years longer.

July 1, 1892, balance unexpended	$2,286.33
July 1, 1893, balance unexpended	2,286.33

(See Appendix J J 8.)

9. Waterway from Keweenaw Bay to Lake Superior, via Portage Lake and River, Michigan.—The work was in the charge of Maj. James F. Gregory, Corps of Engineers, to October 15, 1892. It has heretofore been reported on as the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

The improvements consist of entrance piers at the harbor entrances on Lake Superior and Keweenaw Bay, canals and canal revetments,

dredged cuts and channel ways, lights and buoys. There are no locks. When the United States assumed charge the piers and revetments were, and are now, in a dilapidated condition, bars had formed at the harbor entrances, and many places in the channel ways had shoals by deposition of material.

As the waterway is intended for the use of all vessels that navigate Lake Superior, and is actually used by a large proportion of them, it is necessary that the depth and width of the channels shall at least be equal to that of the St. Marys Falls Canal, which now limits the maximum draft and dimensions of the largest vessels which run to Lake Superior.

The last river and harbor act appropriated $50,000 for improvement, which is being expended in dredging the existing channels to a 16-foot depth and in repairing some of the worst portions of the canal revetments.

The condition of the waterway has been greatly bettered since the United States acquired ownership, and no complaints from vessel men have been received this year. A least depth of 14 feet exists throughout the waterway. A legislative enactment imposing severe penalties for a violation of the established rules and regulations for the use of the canals is urgently needed.

Amount appropriated by act approved July 13, 1892	$50,000.00
June 30, 1893, amount expended during fiscal year	11,834.48
July 1, 1893, balance unexpended	38,165.52
July 1, 1893, outstanding liabilities	2,511.82
July 1, 1893, balance available	35,653.70
Amount (estimated) required for completion of existing project	1,245,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	800,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 9.)

10. Operating and care of waterway from Keweenaw Bay to Lake Superior, via Portage Lake and River, Michigan.—The expenses of operating and care of this waterway for the fiscal year ending June 30, 1892, during which it was acquired by the United States, were paid by an appropriation of $10,000 made for the purpose by act of September 19, 1890.

During the fiscal year ending June 30, 1893, $30,910.64 (including $19.85 liabilities outstanding July 1, 1893) from the permanent indefinite appropriation of July 5, 1884, was expended in maintaining, by dredging, a practicable 14-foot stage of water, in buoying and lighting the channels, in superintendence and general operation of the canals, and in guarding against encroachments on the legally established harbor lines.

(See Appendix J J 9.)

11. Harbor at Marquette, Mich.—Originally this harbor afforded no protection to vessels from easterly or northeasterly storms, and in 1866 a project was approved for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 2,000 feet. This pier was finished practically as projected in 1875, but since its commencement extensive repairs have been made to the superstructure.

As the timber composing the superstructure has been in place longer than its durability justifies, it is essential that it be replaced by more durable material. A project for a concrete superstructure was approved in February, 1890. Its estimated cost is $232,936.71.

In the river and harbor act of August 11, 1888, provision was made for the extension of the breakwater. There was finished 60 feet of crib work and 180 feet of riprap foundation. The contract of 1890 extended the breakwater 240 feet, leaving 700 feet to be built to complete it.

Under the existing contract, which is to be completed by October 15, 1893, 600 feet of the extension will be built, making 900 feet of the extension and total length of breakwater 2,900 feet.

The breakwater in its present condition gives much protection to the harbor.

The amount expended during the fiscal year ending June 30, 1893, was $22,884.95.

The total cost of the work to June 30, 1892, was $379,569.18.

July 1, 1892, balance unexpended		$14,660.82
Amount appropriated by act approved July 13, 1892		80,000.00
		94,660.82
June 30, 1893, amount expended during fiscal year		22,884.95
July 1, 1893, balance unexpended		71,775.87
July 1, 1893, outstanding liabilities	$14,927.95	
July 1, 1893, amount covered by uncompleted contracts	30,852.00	
		45,779.95
July 1, 1893, balance available		25,995.92

Amount (estimated) required for completion of existing project	257,936.71
Amount that can be profitably expended in fiscal year ending June 30, 1895	134,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 10.)

12. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but about 6 feet depth of water upon it. The project for its improvement, adopted in 1881, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers projecting into the lake and dredging out a channel between them, connecting the deep water of the lake with that of the harbor.

The proposed length of each pier was 1,800 feet. The west pier has now reached a length of 1,406 feet and the east pier 853 feet.

A channel 150 feet wide and 17 feet deep was dredged out between the piers in 1889, but it shoaled, and in 1891 it was again dredged, this time to a width of 175 feet and a least depth of over 17 feet, the outer ends of canal piers repaired, new shore ends and spurs put in, and the old shore ends remodeled. A partial survey in June, 1893, shows a shoaling to 14 feet. Under existing contract, to be completed October 15, 1893, the east pier will be extended 300 feet and have a total length of 1,153 feet, including 100 feet of pile dike.

The total amount expended under approved project to June 30, 1892, was $226,608.06.

The amount expended during the year ending June 30, 1893, was $966.87.

July 1, 1892, balance unexpended	$4,641.94
Amount appropriated by act approved July 13, 1892	30,000.00
	34,641.94
June 30, 1893, amount expended during fiscal year	966.87
July 1, 1893, balance unexpended	33,675.07
July 1, 1893, amount covered by uncompleted contracts	27,000.00
July 1, 1893, balance available	6,675.07

Amount (estimated) required for completion of existing project	188,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix J J 11.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *Allouez Bay and Nemadji River, at Superior, Wisconsin*, required by act of July 13, 1892, was made by the local engineer, Maj. Clinton B. Sears, Corps of Engineers, and his report thereon, dated November 10, 1892, was submitted through the division engineer, Col. O. M. Poe, Corps of Engineers. It is the opinion of Maj. Sears and that of the division engineer, concurred in by this office, (1) that Nemadji River is not worthy of improvement by the General Government at the present time, and (2) that Allouez Bay is worthy of improvement. The cost of a survey necessary for preparation of project and estimate of cost of improvement of Allouez Bay is estimated at $1,200. The report was transmitted to Congress and printed as House Ex. Doc. No. 49, Fifty-second Congress, second session. (See also Appendix J J 12.)

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Maj. James F. Gregory, Corps of Engineers, having under his immediate orders Lieut. H. E. Waterman, Corps of Engineers, to April 29, 1893, and Lieut. Charles H. McKinstry, Corps of Engineers, since June 12, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Manistique Harbor, Michigan.—The natural channel of entrance to the mouth of the Manistique River was 7 feet deep. By private enterprise 3,000 feet of slab piers had been built at the mouth of the river and a channel dredged to 10 feet before any appropriation had been made by the Government.

The project for the improvement of the harbor was adopted in 1880, and consisted in dredging between the piers built by the Chicago Lumbering Company, increasing the depth of the channel to 12 feet for a width of 150 feet.

By the acts of 1880 and 1881 the sum of $6,000 was appropriated for this harbor in order to dredge a channel between the private piers of the above-mentioned dimensions. Dredging was done to the amount of 11,780 cubic yards at a cost of $2,989.21, and work was then suspended in consequence of the refusal of the company controlling the harbor to rectify their pier lines when rebuilding the same.

Nothing has been done since work was suspended in 1881.

Soundings taken in May, 1892, show a navigable channel between

the piers with a depth of 13 feet, but with a governing depth over the bar of about 11 feet.

July 1, 1892, balance unexpended	$2,569.40
June 30, 1893, amount expended during fiscal year	70.00
July 1, 1893, balance unexpended	2,499.40

(See Appendix K K 1.)

2. Cedar River Harbor, Michigan.—Previous to improvement the mouth of Cedar River was 175 feet wide and 8 to 10 feet deep, with a 3-foot bar in front.

Improvements had been made by private parties prior to the commencement of Government work.

The project of improvement was adopted in 1883, with a modification in the direction of the piers in 1884, the object being to afford an entrance channel of navigable width and 14 feet in depth.

Up to June 30, 1892, there had been expended $27,857.93, resulting in the construction of two pile piers 754 and 301 feet long, respectively, in continuation of the slab docks built by private enterprise, and a channel that in October, 1885, was 50 feet wide and 13 feet deep and 100 feet wide for a depth of 11 feet.

Soundings taken in May, 1892, showed a channel 20 feet wide and 12 feet deep; also a channel 10 feet deep with a least width of 40 feet. Dredging by private enterprise was in progress.

Work was suspended in November, 1885, and has not been resumed by the United States since that date. It is reported that some dredging was done by private parties in 1891 and 1892.

July 1, 1892, balance unexpended	$2,142.07
June 30, 1893, amount expended during fiscal year	247.00
July 1, 1893, balance unexpended	1,895.07
Amount (estimated) required for completion of existing project	108,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix K K 2.)

3. Menominee Harbor, Michigan and Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Menominee River was about 4 feet, and the river was navigable for boats of that draft for some 2 miles above its mouth.

The project for the improvement of the harbor was adopted in 1871 and modified in 1874, the object being to afford a channel of entrance of navigable width and not less than 14 feet depth.

The amount expended up to June 30, 1892, was $211,653.27, resulting in the construction of two piers, 400 feet apart, the north pier 1,854 feet long and the south pier 2,710 feet long, with a dredged channel 3,000 feet long, 200 feet wide, and 16 feet deep, from the 16-foot contour in Green Bay to the lower end of the channel of the Menominee River, of the same depth and width.

July 1, 1892, balance unexpended	$378.32
June 30, 1893, amount expended during fiscal year	246.00
July 1, 1893, balance unexpended	132.32
Amount (estimated) required for repairs to piers	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 3.)

4. Menominee River, Michigan and Wisconsin.—The river and harbor act of September 19, 1890, appropriated $54,000 for "continuing the improvement up the river from termination of old work," and the original approved project was for dredging a channel 200 feet wide and 16 feet deep from Green Bay up the Menominee River as far as the funds available would allow, the object being to create a navigable channel 16 feet deep from Green Bay to N. Ludington Company's mill, a distance of about 2 miles. The project has been modified by reducing the upper 2,600 linear feet to a width of 100 feet.

The total amount expended up to the close of the fiscal year ending June 30, 1892, was $38,145.01 in dredging 230,323 cubic yards of material.

The lower section of 6,550 feet in length had then a channel 200 feet wide and 16 feet deep. The middle section 2,750 feet long had been dredged to a depth of 16 feet for a varying width of 90 to 170 feet, and upon the upper section of 2,400 feet no work had yet been done. The channel had a depth of from 1 to 13 feet.

During the fiscal year ending June 30, 1893, $23,449.86 was expended in drilling and blasting in hardpan, and in dredging 73,165 cubic yards of material, and the work is still in progress. The two lower sections have now a channel 200 feet wide, except for a limited portion of their length, and a general depth of 16 feet. The upper section is practically completed for about 1,000 linear feet, and the governing depth in the remainder is about 4 feet.

July 1, 1892, balance unexpended		$15,854.99
Received from United States attorney for damage to dredging plant		53.50
Amount appropriated by act approved July 13, 1892		20,500.00
		36,408.49
June 30, 1893, amount expended during fiscal year		23,449.86
July 1, 1893, balance unexpended		12,958.63
July 1, 1893, outstanding liabilities		39.98
July 1, 1893, balance available		12,918.65
Amount (estimated) required for maintenance of channel		10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix K K 4.)

5. Oconto Harbor, Wisconsin.—In its natural condition the channel at the entrance to the Oconto River was obstructed by a bar with less than 2 feet of water over it. Previous to 1881, when the first appropriation was made for its improvement, the citizens, by the construction of a small amount of slab pier and by dredging, had increased the depth to 3½ feet.

The project of improvement, adopted in 1882, proposes to secure an 8-foot channel from Green Bay to the city of Oconto, a distance of 2 miles, by dredging and constructing piers, at an estimated cost of $150,000.

The total amount expended up to June 30, 1892, was $67,890.77, resulting in the building of two piers, the north pier 1,603 feet and the south pier 2,151 feet in length, the latter being the full length contemplated by the approved project in the removal of 405,356 cubic yards of material and minor repairs. Owing to the narrowness of the dredged channel and the soft character of the material the spring freshets have a tendency to obliterate the dredging of the previous year.

There were no operations during the fiscal year ending June 30, 1893.

Soundings taken in April, 1893, show the governing depth to be about 7½ feet at the harbor entrance and about 7 feet in the river as far up as Spies' Mill.

July 1, 1892, balance unexpended	$109.23
Amount appropriated by act approved July 13, 1892	3,000.00
	3,109.23
June 30, 1893, amount expended during fiscal year	19.90
July 1, 1893, balance unexpended	3,089.33
Amount (estimated) required for completion of existing project	79,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 5.)

6. Pensaukee Harbor, Wisconsin.—The original depth of water at the mouth of Pensaukee River was 2 feet, increased by private enterprise to from 7 to 9 feet for a width of 30 feet.

The project for the improvement of this harbor was adopted in 1883, and consisted of the construction of a single slab pier 2,500 feet long, in continuation of the pier built by private enterprise, and dredging a channel 10 feet deep and 100 feet wide on the south side of the pier.

The total amount expended up to June 30, 1892, was $13,863.64, resulting in the construction of 1,300 feet of the proposed extension of the pier, and the dredging of 5,698 cubic yards of material, making a channel 25 feet wide and 10 feet deep.

About 600 linear feet of the west end of the pier, damaged by fire in September, 1891, was repaired in October and November, 1891.

The last survey, made in May, 1890, showed the governing depth to to be 2.8 feet.

July 1, 1892, balance unexpended	$1,135.36
June 30, 1893, amount expended during fiscal year	71.00
July 1, 1893, balance unexpended	1,064.36
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 6.)

7. Green Bay Harbor, Wisconsin.—Before the improvement of this harbor was begun the channel between the mouth of the Fox River and the deep water in Green Bay was circuitous and narrow, with but 6 feet of water at its shoalest point.

The project of improvement was adopted in 1866, and subsequently modified, so as to provide increased depth, in 1872 and 1874, the object being to provide a dredged channel 200 feet wide, 14 feet deep, and 2 miles long in place of the natural channel, with a revetted cut across Grassy Island.

The project was further modified in 1892 to increase the depth of the present channel to 16 feet and extend it in a direct line through the bar off Sable Point, making its total length 16,500 feet.

The act of Congress of July 13, 1892, appropriating $25,000 for improving harbor at Green Bay, Wis., provided "that $5,000 of said sum may, in the discretion of the Secretary of War, be expended on the Fox River, below De Pere, Wisconsin."

During the last fiscal year 50,197.2 cubic yards was removed from the channel way between the mouth of the Fox River and Green Bay. This work is still in progress.

From the channel of the Fox River between De Pere and Green Bay, 41,575 cubic yards of material was removed, resulting in a channel way 14 feet deep and 145 feet wide, except for a small part of the distance.

There was expended up to the close of the fiscal year ending June 30, 1892, $293,751.95, resulting in a dredged channel 10,600 feet long, 200 feet wide, and 14 feet deep, and in the construction of 1,325 linear feet of revetment of the sides of a cut through Grassy Island.

During the year ending June 30, 1893, $7,296.52 was expended in dredging.

July 1, 1892, balance unexpended		$3,829.05
Amount appropriated by act approved July 13, 1892		25,000.00
		28,829.05
June 30, 1893, amount expended during fiscal year		7,296.52
July 1, 1893, balance unexpended		21,532.53
July 1, 1893, outstanding liabilities	$4,337.32	
July 1, 1893, amount covered by uncompleted contracts	12,675.15	
		17,012.47
July 1, 1893, balance available		4,520.06

Amount (estimated) required for completion of existing project	71,915.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	66,915.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 7.)

8. Sturgeon Bay and Lake Michigan Canal, Wisconsin.—The Sturgeon Bay and Lake Michigan Canal is a waterway cut through the neck of land separating Green Bay from Lake Michigan, and connects Lake Michigan with Sturgeon Bay, an arm of Green Bay about 8 miles long extending eastward into the peninsula and narrowing it at that point.

The canal was constructed by the Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company, from 1872 to 1881, from the proceeds of sale of 200,000 acres of public lands granted to the State of Wisconsin for the purpose by acts of Congress of April 10, 1866, and March 1, 1872. A full history and description of the work is given in reports contained in the Annual Report, Chief of Engineers, 1887, pages 2017 to 2037, and in House Ex. Doc. No. 106, Forty-ninth Congress, second session.

The canal affords a considerable shortening of distance for many vessels over the natural outlet of Green Bay into Lake Michigan about 50 miles to the north, admits the avoidance of the dangers of the natural route, and makes Sturgeon Bay available and accessible as a harbor of refuge for vessels on Lake Michigan.

The river and harbor act approved July 13, 1892, appropriated $81,833 for making the canal free to commerce. The conditions of the act being fulfilled, the property was purchased from the company and the money appropriated therefor paid in April, 1893, and the United States assumed possession of the canal on April 25, 1893.

The canal is an open cut, without locks or gates, 7,200 long; it is 100 feet wide at the water surface and about 65 feet wide at bottom. Harbor works at the Lake Michigan entrance have been constructed by the United States. (See below.) Dredging has been done in continuation of the channel 6,100 feet into Sturgeon Bay. The channel through

the canal is 13 feet deep, and is in fair navigable condition for vessels not exceeding that draft. The banks are only partly revetted; 8,437 feet of the existing revetments requires extensive repairs, and 6,000 feet remains to be constructed.

Amount appropriated by act approved July 13, 1892	$81,833.00
June 30, 1893, amount expended during fiscal year	81,833.00
Amount (estimated) required for completion of existing project	98,450.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	98,450.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 8.)

9. Operating and care of Sturgeon Bay and Lake Michigan Canal, Wisconsin.—Under the continuous appropriation for operating and care of canals and other works of navigation it is proposed to maintain existing navigation, make necessary repairs to canal banks, revetments, etc., pertaining to the present canal, and to dredge so much as may be required to keep the present depth of water.

The amount expended under the indefinite appropriation provided by section 4 of the river and harbor act of July 5, 1884, from April 25, when the United States assumed charge of the canal, up to the close of the fiscal year was $555.26. The detailed statement appended to the report of the local engineer officer shows the items of expenditure.

(See Appendix K K 9.)

10. Harbor of refuge at eastern entrance of Sturgeon Bay and Lake Michigan Canal, Wisconsin.—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms ranging from northeast to southwest.

The project of constructing a harbor of refuge at this point was adopted in 1873 and modified in 1879 and 1880. The modified project, as carried out, consists of two piers, each 1,344 feet long, 850 feet apart at the shore line, protecting the lake entrance of the canal, and converging so as to make the harbor entrance 335 feet wide, inclosing an area of about 10 acres, with a depth of at least 16 feet.

The total expenditure at this harbor up to June 30, 1892, was $166,773.40, resulting in the completion of the piers as projected and in a dredged channel 16 feet deep and 120 feet wide from the 16-foot contour in Lake Michigan to the canal entrance.

During the fiscal year ending June 30, 1893, repairs were made to the sheet piling of the north pier, the guide piling of the south pier, and the dredging plant. Ten thousand six hundred and sixty cubic yards of material was removed from the channel in July, 1892.

Soundings taken in April, 1893, show that the governing depth has been reduced by deposits of material to 14.3 feet.

July 1, 1892, balance unexpended	$1,221.60
Amount appropriated by act approved July 13, 1892	5,000.00
	6,221.60
June 30, 1893, amount expended during fiscal year	2,657.06
July 1, 1893, balance unexpended	3,564.54
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix KK 10.)

11. Ahnapee Harbor, Wisconsin.—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee River was only about 2 feet.

The project of improvement, adopted in 1875 and modified in 1884, provided for the formation of a small artificial harbor connected with the lake by a channel 100 feet wide and 12 feet deep, formed by the construction of two piers extending to the 18-foot contour, with a 200-foot entrance between the pier heads.

The total amount expended up to June 30, 1892, was $165,240.80, resulting in the construction of two piers, the north one 1,102 feet long and the south one 1,125 feet; in the removal of 30,528 cubic yards of rock and 135,843 cubic yards of sand and gravel, and in placing a double row of sheet piling along 352 feet of the north pier. The rock was used for refilling and riprapping the piers.

During the fiscal year ending June 30, 1893, $1,382.80 has been expended in making minor repairs to the south pier and removing 2,140 cubic yards of material from shoal places in the channel.

July 1, 1892, balance unexpended	$694.70
Amount appropriated by act approved July 13, 1892	7,000.00
	7,694.70
June 30, 1893, amount expended during fiscal year	1,382.80
July 1, 1893, balance unexpended	6,311.90
July 1, 1893, amount covered by uncompleted contracts	3,000.00
July 1, 1893, balance available	3,311.90

Amount (estimated) required for completion of existing project (including $8,000 for rebuilding superstructure of pile pier)	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 11.)

12. Kewaunee Harbor, Wisconsin.—The natural entrance to this harbor was through the Kewaunee River. The River mouth was not more than 20 feet wide, with a depth of about 2 feet at its shoalest point, and was obstructed by submerged bowlders.

The project of improvement was adopted in 1881. Its design was to cut a channel 14 feet deep through a neck of land between the river and the lake at a point about 2,000 feet south of the river mouth, and to continue this channel to deep water in the lake by the construction of two parallel piers 200 feet apart, extending from each side of the cut lakeward to the 18-foot contour.

The total amount expended on this harbor up to the close of the fiscal year ending June 30, 1892, was $74,621.93, in addition to which the local harbor commissioners had expended $8,042.72. At that time 1,250 feet of the north pier and 1,125 feet of the south pier had been constructed, and there was a governing depth in the entrance channel of about 11½ feet.

During the fiscal year ending June 30, 1893, $6,394.07 was expended in dredging and pier extension. Further pier extension is now progressing under contract, and will be completed this season.

Soundings taken in April, 1893, showed a channel, centrally located between the piers, 50 feet wide and 13 feet deep.

The completion in October, 1891, of a railroad between Kewaunee and Green Bay, forming with existing railroads and a line of steamers plying across Lake Michigan between Kewaunee and Frankfort, Mich.,

a through route of transportation between the Missouri River and the Atlantic seaboard, has greatly increased the importance of this harbor. Two steamers, for the carriage of twenty-four cars each between Kewaunee and Frankfort, each 256 feet over all, 54 feet beam, and drawing 12 feet of water, have been operated during the past winter and spring.

July 1, 1892, balance unexpended	$343.67
Amount appropriated by act approved July 13, 1892	30,000.00
	30,343.67
June 30, 1893, amount expended during fiscal year	6,394.07
July 1, 1893, balance unexpended	23,949.60
July 1, 1893, amount covered by uncompleted contracts	20,392.75
July 1, 1893, balance available	3,556.85
Amount (estimated) required for completion of existing project	86,957.28
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	75,000.00

(See Appendix K K 12.)

13. Two Rivers Harbor, Wisconsin.—Previous to the improvement of this harbor the natural channel was obstructed by a bar covered by but 2 or 3 feet of water.

The project of improvement adopted in 1870 provided for the formation of a channel of navigable width and not less than 12 feet deep, to be accomplished by the construction of two piers extending from the mouth of Two Rivers lakeward to the 18-foot contour in Lake Michigan and dredging a channel between them.

The amount expended up to the close of the fiscal year ending June 30, 1892, was $202,900.14, which was expended in the construction of two parallel piers, the north and south piers being 1,810 and 1,710 feet long, respectively, in dredging, and in repairs to the piers.

During the fiscal year ending June 30, 1893, $1,587.57 was expended in making minor repairs to south pier and sand fences, in building a new sand fence on the north side of the harbor, and in dredging 16,440 cubic yards of material from the channel.

Soundings taken in April, 1893, showed a governing depth in entrance channel of about 9½ feet. There is at the close of the fiscal year a channel 120 feet wide and 12 feet deep nearly completed.

July 1, 1892, balance unexpended	$599.86
Amount appropriated by act approved July 13, 1892	3,000.00
	3,599.86
June 30, 1893, amount expended during fiscal year	1,587.57
July 1, 1893, balance unexpended	2,012.29
July 1, 1893, outstanding liabilities	141.01
July 1, 1893, balance available	1,871.28
Amount (estimated) required for completion of existing project	59,088.80
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	12,000.00

(See Appendix K K 13.)

14. Manitowoc Harbor, Wisconsin.—Previous to the improvement of this harbor but 3 feet of water existed at the shoalest point over the bar at the mouth of the Manitowoc River.

The original project adopted in 1852 provided for the construction of two parallel piers, 220 feet apart, extending from the mouth of the river to the 12-foot contour in Lake Michigan. In 1881 this was modified so as to secure a deeper channel by extending the piers to a depth of 18½ feet and dredging to not less than 14 feet.

The total amount expended up to June 30, 1892, was $307,067.38, resulting in the construction of two piers, the north one 1,970 feet and the south one 1,900 feet long, 228 feet apart at the shore line and 250 feet at the outer ends, renewal of superstructure of piers, and in the removal of 196,891 cubic yards of material by dredging.

During the fiscal year ending June 30, 1893, $2,207.82 has been expended in dredging 4,173 cubic yards of material from the channel.

Soundings taken in April, 1893, showed a depth of water at entrance of 17 feet and a navigable channel, midway between the piers, about 14.7 feet deep.

July 1, 1892, balance unexpended	$859.75
Amount appropriated by act approved July 13, 1892	28,000.00
	28,859.75
June 30, 1893, amount expended during fiscal year	2,207.82
July 1, 1893, balance unexpended	26,651.93

Amount (estimated) required for completion of existing project (including $26,000 for preservation of piers and maintenance of channel)	38,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	38,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 14.)

15. Sheboygan Harbor, Wisconsin.—Previous to the improvement of this harbor the natural channel had a depth not exceeding 4 feet on the bar at the entrance of the river.

The original project for the improvement of this harbor was adopted in 1852 and had for its object the formation of a 12-foot channel entrance to the mouth of the Sheboygan River. This was modified in 1873, so as to secure a deeper channel by further pier extension and dredging. Both projects were completed within their estimated cost, and a channel was formed 100 feet wide, with a depth of 15 to 16 feet between the piers. This was further modified in 1881, the present project having for its object to deepen the channel still further by extending the piers to the 20-foot contour in the lake and dredging to a depth of 18 feet between their outer ends, the depth decreasing to 14 feet at the shore line.

The total expenditure up to June 30, 1892, amounted to $318,256.03, resulting in the construction of a north and a south pier 2,270 and 2,387 feet long, respectively, and the removal by dredging of 249,548 cubic yards of material.

A survey made in April, 1892, showed a governing depth of water in the channel to be about 13.7 feet.

There was expended during the fiscal year ending June 30, 1893, $6,761.16 in pier extension and dredging. The work of pier extension is now in progress, and the dredging has resulted in a channel midway between the piers 100 feet wide and 16 feet deep.

July 1, 1892, balance unexpended	$132.68
Amount appropriated by act approved July 13, 1892	25,000.00
	25,132.68
June 30, 1893, amount expended during fiscal year	6,761.16
July 1, 1893, balance unexpended	18,371.52
July 1, 1893, amount covered by uncompleted contracts	15,000.00
July 1, 1893, balance available	3,371.52

Amount (estimated) required for completion of existing project (including $64,900 for maintenance and repairs) 106,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 106,900.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K K 15.)

16. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of but 1 foot.

The original project for the improvement of this harbor was adopted in 1869 and provided for two parallel piers, extending to 10 feet of water in Lake Michigan and the excavation of an interior basin. This plan was modified in 1870 and again in 1876, and now provides for the excavation of two interior basins, with a combined area of 5¾ acres, with a depth of 12 feet, and a channel of the same depth connecting the basins with the lake.

The total expenditure up to June 30, 1892, was $177,374.54, and resulted in the construction of a north and south pier, 920 and 1,226 feet long, respectively, with 400 feet of revetment along the north bank of the river, extending to the inner end of the south pier; in the formation of two interior dredged basins of 2¾ and 3 acres, respectively. The north basin had a depth of 12 feet over nearly its entire area, and a narrow channel 12 feet in depth from abreast the inner end of the north pier to the upper end of the west basin, although the average depth did not exceed 8 feet.

There was expended during the fiscal year ending June 30, 1893, $6,347.91 in extending the south pier 100 feet.

Soundings taken in March, 1893, indicated a ruling depth of water in the entrance channel of 10½ feet.

July 1, 1892, balance unexpended	$133.36
Amount appropriated by act approved July 13, 1892	6,500.00
	6,633.36
June 30, 1893, amount expended during fiscal year	6,317.91
July 1, 1893, balance unexpended	285.45

Amount (estimated) required for repairs and dredging 12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K K 16.)

17. Harbor of refuge at Milwaukee Bay, Wisconsin.—The project for the work was approved in 1881, and contemplated the formation of an artificial harbor inclosing a portion of Lake Michigan forming Milwaukee Bay within a breakwater of crib work upon a stone foundation. This harbor will furnish 417 acres of safe mooring ground beyond the 18-foot contour and about twice this area beyond the 12-foot contour.

The actual length of the breakwater when completed will be 7,250 feet.

Work began in 1881, and up to June 30, 1892, there had been expended $469,144.52, 4,150 feet of substructure and 3,850 feet of superstructure being completed.

During the fiscal year ending June 30, 1893, $5,511.58 was expended in part payment for 100 additional feet of substructure and for cost of care, repairs, and lighting. But 100 feet of substructure was removed and 1,600 linear feet of superstructure badly damaged by the storm of April, 1893. The present length of the work is therefore the same as in 1892. The work of repair is in progress at the close of the fiscal year. There remain to be constructed 3,100 feet of substructure and 3,400 feet of superstructure to complete the work.

The harbor is now used to a very considerable extent as a shelter from northeast storms, and its value will rapidly increase as the breakwater is extended.

July 1, 1892, balance unexpended		$16,056.05
Amount appropriated by act approved July 13, 1892		75,000.00
		91,056.05
June 30, 1893, amount expended during fiscal year		5,511.58
July 1, 1893, balance unexpended		85,544.47
July 1, 1893, outstanding liabilities	$9,526.06	
July 1, 1893, amount covered by uncompleted contracts	55,170.25	
		64,696.31
July 1, 1893, balance available		20,848.16

Amount (estimated) required for completion of existing project	234,739.91
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 17.)

18. Milwaukee Harbor, Wisconsin.—The original depth of water at the mouth of the Milwaukee River was not more than 3½ feet.

The original project was adopted in 1852, and was directed to securing 12 feet of water at the entrance to the river and to protecting the channel by parallel piers. In 1868 this was modified so as to secure a channel 18 feet deep by extending the piers 600 feet and dredging. The project has been completed, and consequently the only expenditures now demanded are for the maintenance of the piers by timely repairs and of the depth of the channel by dredging.

Up to the close of the fiscal year ending June 30, 1892, there had been expended on this harbor $330,380.47, in addition to $321,355.66 expended by the city of Milwaukee, resulting in the completion of the modified project of 1868.

During the fiscal year ending June 30, 1893, $7,268.24 has been expended in repairs to south pier and protection piling to north pier.

Soundings taken in May, 1893, show that between the piers there is a channel more than 100 feet wide, having a depth of 17 feet. Outside the pier heads the water is fully 18 feet deep below the datum plane.

July 1, 1892, balance unexpended	$797.51
Amount appropriated by act approved July 13, 1892	14,000.00
	14,797.51
June 30, 1893, amount expended during fiscal year	7,268.24
July 1, 1893, balance unexpended	7,529.27
July 1, 1893, outstanding liabilities	6,275.00
July 1, 1893, balance available	1,254.27

Amount (estimated) required for repairs of piers and dredging	$20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 18.)

19. Racine Harbor, Wisconsin.—The entrance to this harbor originally varied in depth from absolute closure after storms to about 6 feet.

The original project was adopted in 1842 or 1843, and contemplated a channel 12 feet deep. In 1866 the project was modified to provide a channel 15 feet deep.

The project was further modified in 1889, providing for 300 feet extension to the north pier, 500 feet to the south pier, and an increase of channel depth of water to 16 feet.

There has been expended up to June 30, 1892, $280,426.54 in the construction of a north and a south pier 1,460 and 1,270 feet long, respectively, and in dredging the channel to 16 feet depth of water.

Soundings taken in April, 1893, show that but 13 feet of water could be carried into the harbor, and that there was then only a very narrow channel of that depth.

The work is now under contract for extending the north pier 150 feet and the south pier 100 feet.

During the fiscal year ending June 30, 1893, $2,185.38 has been expended in dredging the channel, restoring it to 15 feet in depth for a width of 80 feet.

The constant shoaling at the entrance to this harbor shows that the piers will have to be extended several hundred feet in order to maintain the intended depth. Some 1,100 feet of the superstructure of the piers should be rebuilt.

July 1, 1892, balance unexpended	$1,001.17
Amount appropriated by act approved July 13, 1892	25,000.00
	26,001.17
June 30, 1893, amount expended during fiscal year	2,185.38
July 1, 1893, balance unexpended	23,815.79
July 1, 1893, amount covered by uncompleted contracts	19,500.00
July 1, 1893, balance available	4,315.79

Amount (estimated) required for completion of existing project	39,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	39,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 19.)

20. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from absolute closure to 3 feet.

The original plan of improvement was adopted in 1852, and was directed to securing a channel 12 feet deep by constructing parallel piers and dredging between them. This plan was modified in 1866 so as to secure 15 feet of water by extending the piers and dredging deeper.

A further modification of the project was made in 1889, providing for the extension of the north pier 300 and the south pier 600 feet.

There was expended upon this harbor up to June 30, 1892, $252,607.72, resulting in the construction of two piers, north and south, 1,600 and 950 feet in length, respectively, 150 feet apart, with a channel of varying depth. In 1875 and 1876 the channel was dredged to 15 feet, but subsequent appropriations sufficed only to maintain a channel of about 12 feet. An area of about 3 acres was also dredged in the inner harbor to a depth of 14 feet.

Soundings taken in April, 1892, showed an available depth of channel of only 12½ feet, with a small bank in mid-channel on which there was but 12 feet of water.

Eight thousand and sixty four cubic yards of material was removed from the channel in May and June, 1892, and this work was continued until July 25, 1892, removing in all 15,568 cubic yards.

Soundings taken in April, 1893, showed that a bank had reformed at the extremities of the piers and along the mid-section of the south pier. Dredging was begun again, and on June 30, 1893, 2,693.65 cubic yards had been removed.

During the fiscal year ending June 30, 1893, $3,525.92 was expended in dredging the channel to restore it to a depth of 15 feet and a width of 80 feet and the work is still in progress. The channel can be maintained only by frequent dredging until the piers are further extended.

The work of extending the north pier 100 feet and the south pier 50 feet is now in progress under contract and will probably be completed by October 31, 1893.

July 1, 1892, balance unexpended	$4,374.36
Amount appropriated by act approved July 13, 1892	15,000.00
	19,374.36
June 30, 1893, amount expended during fiscal year	3,525.92
July 1, 1893, balance unexpended	15,848.44
July 1, 1893, amount covered by uncompleted contracts	13,500.00
July 1, 1893, balance available	2,348.44

Amount (estimated) required for completion of existing project	49,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	49,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 20.)

21. Waukegan Harbor, Illinois.—Previous to the improvement there was no navigable channel or natural harbor at this place, the adopted project contemplating the construction of an artificial harbor.

A project was adopted in 1852 which provided for the construction of a breakwater parallel to the shore in 20 feet of water. One crib was placed in position, but was carried away by a storm.

The present project was adopted in 1880, and provides for the construction of an exterior basin of sufficient capacity for local trade by inclosing a portion of Lake Michigan with pile piers, the entrance channel between the piers and the inclosed area to be dredged to 12 feet.

There has been expended on this harbor up to the close of the fiscal year ending June 30, 1892, $137,500.27, resulting in the construction of 2,878.5 feet of pile pier and the removal of 90,588.6 cubic yards of material.

During the fiscal year ending June 30, 1893, $10,654.93 was expended in removing 50,292 cubic yards of material from the entrance channel and basin.

Under contract the work of constructing 376 linear feet of pile pier in extension of the present piers is now favorably progressing and will probably be completed on or before October 31, 1893.

Soundings taken in April, 1893, showed the governing depth in the entrance channel to be about 10½ feet.

July 1, 1892, balance unexpended	$12,499.73
Amount appropriated by act approved July 13, 1892	25,000.00
	37,499.73
June 30, 1893, amount expended during fiscal year	10,654.93
July 1, 1893, balance unexpended	26,844.80
July 1, 1893, amount covered by uncompleted contracts	17,500.00
July 1, 1893, balance available	9,344.80
Amount (estimated) required for completion of existing project	61,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	61,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix K K 21.)

22. Fox River, Wisconsin.—The works for the improvement of the Fox River were purchased by the United States from the Green Bay and Mississippi Canal Company in 1872. With the exception of one stone lock they were all temporary structures, and were in bad condition. There was no low-water navigation on the Upper Fox, and on the Lower Fox navigation was uncertain.

The adopted project for the improvement of the Fox River contemplated the replacing of the temporary structures with permanent works, the construction of five additional locks on the upper river and widening and deepening the channels throughout the river and canals to 6 feet depth and 100 feet width. The estimate for both rivers, made in 1874 and 1876, was $3,745,663.

The work is now carried on under the project of a board of engineers, submitted September 17, 1884, published in the Annual Report of the Chief of Engineers for 1885, approved by the Secretary of War December 10, 1885, as further modified by authority of the Chief of Engineers, May 14, 1886.

The project provides for the renovation of eleven old locks, the deepening and widening of the channel of the Fox River from Montello to Green Bay to 6 feet depth and 100 feet width, and that from Portage to Montello 4 feet of water at low water be maintained. The estimate for this was $602,000.

The amount expended on the Fox and Wisconsin rivers from 1867 up to the close of the fiscal year ending June 30, 1892, including $145,000 paid to the Green Bay and Mississippi Canal Company for works of improvement under act of June 10, 1872, was $2,605,090.24, and under modified project for the Fox River $281,265.06, making a total of $2,886,355.30.

The result of the expenditure upon the Fox River was: The construction of fourteen new locks of stone; seventeen dams, four of which are temporary; twelve cut-offs; a head wall and feeder at the old first lock at Appleton; a wing dam of brush and stone for a shore protection to the Portage Levee; guard gates at head of Kaukauna Canal; a channel 75 feet wide and 450 feet long by blasting and dredging the rock bar below DePere Lock to from 4 to 12 inches below the top of the lower miter sill; channel below DePere excavated to 12½ feet depth for a width of from 50 to 60 feet; deepened channel at mouth of Fond du Lac River; Neenah Channel; Fox River at head of Lake Butte des Morts; Grignon Rapids, and in the canals and Upper Fox River.

During the season of 1891 on the Lower Fox boats drawing 5 feet of water could run from Green Bay to Oshkosh until about August 1,

when the mills at Neenah, Menasha, Appleton, and Kaukauna had drawn the water so low below the crests of the dams that there was not over 3 feet of water in the channel, and at times there was a depth of but 6 inches on the breast wall of the Kaukauna first lock. On the upper river, on account of the low water during September, the larger boats were obliged to lay up for the remainder of the season.

During the season of 1892 there has been a good navigable depth of water.

Navigation was closed by ice November 18, 1892, and resumed along the line from April 11 to 27, 1893.

During the fiscal year ending June 30, 1893, $59,473.84 was expended and the following work done: A new lock has been built to replace the old one at Portage, Wis.; the channel at Grignon Rapids, 80 feet wide, is about completed; a new middle platform was built in the combined locks at Little Chute with new steel valves, gearing, etc., and minor improvements: a portion of the Kaukauna Canal bank was rebuilt and a portion of the canal bed puddled with clay; two new lock-houses were built, and various repairs made to boats, dredges, and quarter boat.

The dredging done in the Fox River between Green Bay and De Pere is given in the report upon improving Green Bay Harbor.

July 1, 1892, balance unexpended	$34,894.70
Amount appropriated by act approved July 13, 1892	75,000.00
	109,894.70
June 30, 1893, amount expended during fiscal year	59,473.84
July 1, 1893, balance unexpended	50,420.86
July 1, 1893, outstanding liabilities	1,806.09
July 1, 1893, balance available	48,614.77

Amount (estimated) required for completion of existing project	271,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix K K 22.)

23. Operating and care of locks and dams on Fox River, Wisconsin.—Under the continuous appropriation for operating and care of canals and other works of navigation, it is proposed to maintain existing navigation by timely repairs to old locks until they are replaced by new, and to continue repairs of works that have already been completed and used, injured by floods or otherwise.

During the fiscal year ending June 30, 1893, $33,551.90 has been expended, the detailed statement appended to the report of the local engineer officer showing the items of expenditure.

(See Appendix K K 23.)

24. Removing sunken vessels or craft obstructing or endangering navigation (wreck of schooner Lumberman 6 miles off Wind Point, Lake Michigan).—As the spars of this wreck projected above the lake surface from just above the crosstrees, they were a dangerous obstruction to navigation, as the vessel lay, in 11 fathoms of water, directly on the course between Racine and Milwaukee. On June 23, 1893, the spars and jib-boom were removed, and no part of the wreck is now less than 45 feet below the water surface. It is therefore no longer an obstruction to navigation. The cost of the work was $200. (See Appendix K K 24.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. James F. Gregory, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Green Bay, Wisconsin, from light-house to first bridge on Fox River.—Maj. Gregory submitted report of examination under date of August 29, 1892. It is his opinion and that of the division engineer, concurred in by this office, that, excepting that part of the dredged cut included in the general project for improving harbor at Green Bay, the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 22, Fifty-second Congress, second session. (See also Appendix K K 25.)

2. Fox River, Wisconsin, as to necessity and advisability of building a protection wall on the canal at Kaukauna.—Maj. Gregory submitted report of examination under date of August 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the improvement proposed is not worthy of being made by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 28, Fifty-second Congress, second session. (See also Appendix K K 26.)

3. Harbor at Stockbridge, on Lake Winnebago, Wisconsin.—Maj. Gregory submitted report of examination under date of August 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at present worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 78, Fifty-second Congress, second session. (See also Appendix K K 27.)

4. Harbor at Calumet, on Lake Winnebago, Wisconsin.—Maj. Gregory submitted report of examination under date of August 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 117, Fifty-second Congress, second session. (See also Appendix K K 28.)

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS AND ILLINOIS RIVER, ILLINOIS, AND CALUMET RIVER, ILLINOIS AND INDIANA; ILLINOIS AND MISSISSIPPI CANAL.

This district was in the charge of Capt. W. L. Marshall, Corps of Engineers, having under his immediate orders Lieut. Chester Harding, Corps of Engineers, the entire year, and Lieut. Henry Jervey, Corps of Engineers, since March 12, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Chicago Harbor, Illinois.—The present project was adopted in 1870, and contemplated—

a. The formation of an outer harbor or basin, by inclosing a portion of Lake Michigan just south of and adjoining the entrance to Chicago River, for the purpose of increasing the harbor facilities of Chicago.

b. The construction of an exterior breakwater in deep water north of the entrance to Chicago River and about one mile distant, to shelter the approach to the river and outer harbor entrance, and to form a harbor of refuge at the southern end of Lake Michigan.

There has been expended upon this project since 1870 $1,722,158.13, which expenditure has resulted in the completion of the outer harbor, except 267,000 cubic yards of dredging still remaining to be done to attain 16 feet depth of water at low water throughout the required basin; in the completion of the exterior breakwater, 5,413 feet in length; in keeping the entrance to Chicago River, which constitutes the inner harbor of Chicago, dredged; in maintaining the various piers and breakwaters, and in maintaining in serviceable condition the plant pertaining to the work.

During the fiscal year ending June 30, 1893, the work consisted in—

a. Exterior breakwater.—No work was done upon this construction, it having been completed.

b. Outer basin and south pier, Chicago Harbor.—Contracts were entered into for rebuilding superstructures over 3,725 linear feet of pier work October 28, 1892, and during the fiscal year 179,428 feet, B. M., pine timber and 20,700 pounds drift bolts have been secured in the work over the southerly breakwater outer basin. The work is in progress under contract named, that expires December 1, 1893.

Dredging entrance to Chicago River.—The entrance to Chicago River has been dredged to a depth of 20 feet, and 34,056 cubic yards of the material dredged paid for under contract. This depth exceeds by 4 feet the stipulated depth; the excess was not paid for.

By the end of the next fiscal year the superstructures over the piers of the outer basin and along the entrance to Chicago River will have been renewed, and there is now in need of repair 3,240 linear feet of superstructure over the exterior breakwater built in 1881–1883. The estimate submitted is for this work of maintenance only; the superstructure to be built of timber, cribwork, and stone, that method being as yet more economical than permanent work of stone or concrete, estimating money at 4 per cent interest per annum and the lifetime of timber at 12 years.

There is also a large amount of dredging to be done in the outer harbor, estimated at 267,000 cubic yards, to give 16 feet of water beyond the dock lines. This work is not pressing and should await the settlement of the question as to the disposition of that part of the area inclosed by the United States piers shoreward of the dock line.

The outer basin has never fulfilled the purposes of its construction, except partially during the latter part of the fiscal year, when it has been in use for the purposes of the World's Columbian Exposition, and the expenditures of the Government thereon should await and be based upon its use and value for the public.

In compliance with a requirement in the river and harbor act of July 13, 1892, the engineer in charge submits a report, with estimates, upon improving Chicago River.

July 1, 1892, balance unexpended		$1,609.77
December 7, 1892, received from Maj. J. F. Gregory (transfer tug *Lorena*)		500.00
Amount appropriated by act approved July 13, 1892		72,000.00
		74,109.77
June 30, 1893, amount expended during fiscal year		11,329.18
July 1, 1893, balance unexpended		62,780.59
July 1, 1893, outstanding liabilities	$117.27	
July 1, 1893, amount covered by uncompleted contracts	37,850.77	
		37,968.04
July 1, 1893, balance available		24,812.55

Amount (estimated) required for maintenance	$80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	80,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L L 1.)

2. Calumet Harbor, Illinois.—This improvement is to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by parallel piers 300 feet apart, extending from shore to deep water in the lake, and by dredging between them to 16 feet in depth at low water.

The work commenced in 1870, and at the close of the fiscal year ending June 30, 1893, there had been expended $437,007.06, as the result of which 3,640 linear feet of the north pier and 2,020 linear feet of the south pier have been completed, and 471,364 cubic yards of material dredged, giving a channel 16 feet in depth instead of 7 feet, as originally existed.

The channel is now 250 feet in width, 16 feet in depth below extreme low water in Lake Michigan, and extends from a similar depth in Lake Michigan to the beginning of the 16-foot channel in the Calumet River.

During the fiscal year ending June 30, 1893, a contract was entered into for rebuilding superstructure over 1,600 linear feet of pier work, and for 320 linear feet of sheet piling. All of this work has been completed during the past fiscal year, except the sheet piling; 303,512 feet, B. M., pine timber, and 36,748 pounds iron driftbolts were placed in the work; 51 piles were driven and capped with oak timbers.

One thousand eight hundred and thirty-seven linear feet of superstructure over the piers is in need of repair, a large part of which is in a deplorable state of decay.

The south pier should be prolonged 800 feet, but until the existing work is put in thorough repair it is not advisable to further extend the work.

The estimate submitted is therefore for maintenance and repair only, the project for this harbor, as far as approved, having been completed.

July 1, 1892, balance unexpended	$8,455.95
Amount appropriated by act approved July 13, 1892	15,000.00
	23,455.95
June 30, 1893, amount expended during fiscal year	13,075.01
July 1, 1893, balance unexpended	10,380.94
July 1, 1893, amount covered by uncompleted contracts	5,140.41
July 1, 1893, balance available	5,240.53

Amount (estimated) required for maintenance and repair	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L L 2.)

3. Calumet River, Illinois and Indiana.—The object of this improvement as far as projected is to secure a channel 200 feet in width and 16 feet in depth below low-water plane in Lake Michigan, from the mouth of the Calumet River, at Calumet Harbor, Illinois, to one-half mile east of Hammond, Ind., with a view to increasing the facility for handling the commerce of this region, and also to aid in providing means for the better accommodation of much of the commerce of Chicago River, which river is very much crowded. The original depth of navigation in this river varied from 6 to 10 feet.

The various acts of Congress and the limitations made by law upon the expenditure of the appropriations thereby made before work was systematically inaugurated upon this improvement are given in the Annual Report of the Chief of Engineers for the year ending June 30, 1889.

Since the beginning of the improvement there has been removed 1,137,456 cubic yards of material, making a channel 3 miles and 345 feet in length, of which a short portion, where rock and other undredgable material was encountered, is incomplete, there remaining less than 9,000 cubic yards to be removed.

This material can be most economically removed after all of this class shall have been revealed by further work.

The amount expended by the United States to the close of the fiscal year ending June 30, 1893, is $181,868.83, of which $155,772.78 has been expended below the Forks of the Calumet, including $5,000 paid for legal expenses in securing rights of way and releases from damages due the proposed improvement, required by the act of July 5, 1884, and $26,096.05 for work between the Forks of the Calumet River and one-half mile east of Hammond, Ind.

During the past fiscal year contracts were entered into for dredging 400,000 cubic yards of material below the Forks and 90,000 cubic yards above the Forks, under the terms of the river and harbor act of July 13, 1892. Work is now in progress, but no estimates have yet been paid the contractors, the conditions upon which payments can be made not having as yet been met by them.

The annual fill, due to rains and floods in the Calumet River and the waste due to habitation, rapidly reduces the depths secured by dredging in this river, and it seems advisable that the appropriations made by Congress should be distinctly specified, whether intended to prosecute the work or for maintaining depths in the improved section. Without dredging at frequent intervals the improved channel will revert to the original discharge area or capacity.

July 1, 1892, balance unexpended		$9,508.61
August 16, 1892, amount refunded (sale of fuel)		25.14
Amount appropriated by act approved July 13, 1892		75,000.00
		84,533.75
June 30, 1893, amount expended during fiscal year		12,377.74
July 1, 1893, balance unexpended		72,156.01
July 1, 1893, outstanding liabilities	$58.90	
July 1, 1893, amount covered by uncompleted contracts	55,130.00	
		55,188.90
July 1, 1893, balance available		16,967.11

Amount (estimated) required for completion of existing project	745,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L L 3.)

4. Illinois River, Illinois.—The present project contemplates the extension of the work heretofore done by the State of Illinois, from the mouth of Copperas Creek to the Mississippi River, a distance of about 135 miles, which project includes the building of two locks 350 feet long between miter sills, 75 feet in width of lock chamber, with 7 feet of water over the miter sills at low-water level of 1879, and dredging the channel where necessary to attain 7 feet depth at low water in the pools thus created.

The sites selected for the two locks are, one at Kampsville, 31 miles above the mouth of the Illinois; the other at La Grange, 79 miles above the mouth of the river.

The ultimate object of the improvement is the construction of a waterway from the southern end of Lake Michigan to the Mississippi River of sufficient capacity to accommodate large-sized Mississippi River steamboats and for military and naval purposes.

The State of Illinois, aided by the United States, has executed part of the project by the construction of two locks of the dimensions above stated, one at Henry and one at Copperas Creek, respectively, completing, excepting dredging, that part of the improvement between La Salle, Ill., and the mouth of Copperas Creek.

The La Grange lock and dam are completed and in use.

The Kampsville lock is completed, and with its gates, etc., is nearly ready for use; part of the dam, with its abutment, is in place. The piles, timber, and stone for its completion have been purchased and are ready for delivery. If low water supervenes, this lock will be open to navigation before the close of this season.

There remains to be done under the approved project the following work:

At *La Grange Lock* some 2,400 cubic yards of riprap to be placed below the dam to protect the river bottom against scour, and an additional small building to lodge the locktenders and skilled laborers.

The *Kampsville Dam and connecting levees* are to be completed; the cofferdam and approaches to the lock to be dredged out to give access to the lock; accommodations for the lock-tending force to be built, and the grounds about the lock and dam to be cleared, sodded, and graded. The channels throughout the pools and between Kampsville and the Mississippi River are to be dredged to 7 feet depth.

In executing the work the United States have expended up to June 30, 1892, $1,145,886.56, including $25,000 from the appropriation of August 11, 1888, for surveys, and excluding $62,359.80 expended upon the foundation of Copperas Creek lock, afterwards completed by the State of Illinois.

An additional amount of $747,747 was expended by the State of Illinois at Henry and Copperas Creek locks.

During the fiscal year ending June 30, 1893, the following work was done:

a. La Grange Lock.—The necessary dredging was done to maintain navigation.

b. Kampsville Lock and Dam.—The masonry of the lock and abutment to dam was completed; 2,334 cubic yards of masonry was set; the lock gates and valve platform were built and made ready for use; 46,922 cubic yards of earthwork, dredging, and filling done; 115 cubic yards of masonry set in the abutment of dam; 220 piles driven for the dam, and 380 cubic yards of riprap placed between them. Sheet piles were driven along the front of the piles, completing 258 linear feet of the base of the dam up to a level 1 foot below low water. Two dump scows were completed and extensive repairs were made to the plant, and the property, plant, and appliances watched and kept in working condition.

The dredges and other floating property pertaining to this work are nearly unserviceable from decay, the work which should have been completed in four years at most having been delayed by meager appropriations for longer than the serviceable life of timber constructions in this latitude. Much of the expenditure for this work for the past four years has been for repairs on worn-out and rotten appliances,

which could not be replaced by new on account of small appropriations and nearness to completion of the work.

July 1, 1892, balance unexpended	$55,310.86
November 19, 1892, amount refunded (sale of fuel)	43.20
February 9, 1893, amount refunded (overcharge freight, etc., on lumber)	458.45
Amount appropriated by act approved July 13, 1892	100,000.00
	155,812.51
June 30, 1893, amount expended during fiscal year	78,968.37
July 1, 1893, balance unexpended	76,844.14
July 1, 1893, outstanding liabilities	19,115.76
July 1, 1893, balance available	57,728.38
Amount (estimated) required for completion of existing project	112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	112,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix L L 4.)

5. Operating and care of La Grange Lock and Dam, Illinois River, Illinois.—This lock and dam have been maintained and operated under the general indefinite appropriation for "operating and care of canals and other works of navigation," contained in the river and harbor act of July 5, 1884, section 4. The approaches to the lock have been kept dredged and the lock maintained in serviceable condition by necessary repairs.

Five hundred cubic yards of riprap was placed below the apron of dam.

Due to long-continued high water, the lockages during the past year were less in number than in 1892, but the number of craft passing the site of the lock, and the tonnage of the same, show a gratifying increase, the tonnage having increased from 138,000 tons in 1892 to 179,000 tons in 1893, and the number of craft from 432 in 1892 to 475 in 1893.

The amount expended during fiscal year ending June 30, 1893, was $4,709.11.

(See Appendix L L 5.)

6. Illinois and Mississippi Canal, Illinois.—The object of this improvement is to furnish a link in a navigable water route from Lake Michigan, at or near Chicago, Ill., to the Mississippi River, at the mouth of Rock River.

The canal is located upon the route approved by the Secretary of War October 27, 1888, from the Illinois River, about 1½ miles above the town of Hennepin, at the great bend of the Illinois River; thence via Bureau Creek Valley to Rock River at Penney Slough; thence by slack water and a short canal around the lower rapids of Rock River, to its mouth. The canal is to be 80 feet wide at the water surface, 7 feet deep, and with lock chambers 170 feet in length and 35 feet in width.

A report upon the detailed location, plans, and estimates for the construction of this canal was submitted June 21, 1890, and published by Congress as House Ex. Doc. No. 429, Fifty-first Congress, first session.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of this canal, and directed work to be begun by the construction of one of the locks and dams on Rock River.

Western section.—The right of way for the section of the canal 5 miles or less in length around the Lower Rapids of Rock River having been acquired, contracts were made during the fiscal year for constructing 3 miles or less of the canal trunk, and for preparing the foundations

of three locks. The work was carried on as flood and weather permitted. Two of the three lock pits and foundations were completed, and about 300,000 cubic yards of earthwork in the canal trunk excavated or placed in embankment. The third lock pit, due to failure of the contractor, is partially completed.

By hired labor three of the four abutments for the dams across the two arms of Rock River, at the head of the rapids, were constructed of artificial stone; the foundation of the lock walls at Guard Lock prepared, and the artificial stone head and tail bay floors and miter sills at Guard Lock laid; a large culvert under the canal below the lock begun; about 50,000 cubic yards of earth and stone excavation and embankment completed; the necessary temporary storehouses, etc., built, and plant and material collected for the prosecution of the work.

The most difficult part of the work has been undertaken by hired labor. The progress by this method has been slow and expensive, much preliminary work of preparation having been necessary.

Eastern section.—A survey party has been employed for part of the fiscal year in definitely locating the section of the canal from the summit level to the Illinois River, making legal descriptions of the lands required for right of way, securing abstracts of title, and obtaining offers for voluntary sale and purchase of such lands.

This section of the canal has been staked out upon the ground, and the descriptions, plats, abstracts of title, and written options for the sale and purchase of the lands required are well along. A party is engaged in running lines from the feeder junction to Rock River with a view to ascertaining the best location for that part of the canal.

Nothing has been done at the feeder line. It is expected as fast as they can be prepared the necessary plats and descriptions of lands required for right of way will be placed in the hands of the officers of the Department of Justice for obtaining the necessary titles.

July 1, 1892, balance unexpended		$463,795.99
September 13, 1892, amount refunded (overpayment)		.50
Amount appropriated by act approved July 13, 1892		500,000.00
		963,796.49
June 30, 1893, amount expended during fiscal year		153,612.88
July 1, 1893, balance unexpended		810,183.61
July 1, 1893, outstanding liabilities	$20,354.84	
July 1, 1893, amount covered by uncompleted contracts	23,301.99	
		43,656.83
July 1, 1893, balance available		766,526.78
Amount (estimated) required for completion of existing project		5,925,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix L L 6.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. W. L. Marshall, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers.

1. Outer harbor at mouth of Calumet River, Illinois.—Capt. Marshall submitted report of examination under date of April 1, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the construction of an outer harbor at this locality is an improvement worthy of being undertaken by the United States, not, however, to enable the transaction of business in it, but for the purpose of providing by breakwaters a safe-sheltered entrance to the harbors at South Chicago. Sufficient information and data are on hand, derived from a recent detailed survey, for the preparation of project and estimate of cost of improvement, and no further survey is necessary. (See Appendix L L 7.)

2. Wolf River Harbor, Indiana, on Lake Michigan; and whether Wolf River and Lake are navigable waterways of the United States, and whether covered in whole or in part by claims of private ownership.—Capt. Marshall submitted report of examination under date of December 29, 1892. It appears that, properly speaking, there is no "harbor" of Wolf River now existing. It is the opinion of Capt. Marshall and that of the division engineer, concurred in by this office, that no public interest can be subserved by the construction of a harbor at the outlet of Wolf Lake, and that the locality is not at this time worthy of improvement by the General Government.

In further compliance with the terms of the act, Capt. Marshall states that Wolf River and Lake are not navigable waters of the United States in the sense that they can be used to carry on commerce by water in any ordinary way between the States of the United States or with foreign countries; and that the area covered by Wolf Lake is embraced in whole or in part by claims of private ownership, the title to that part of the territory in question lying in the State of Illinois being a matter now before the courts for settlement.

The report was transmitted to Congress and printed as House Ex. Doc. No. 169, Fifty-second Congress, second session. (See also Appendix L L 8.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN MICHIGAN AND OF MICHIGAN CITY HARBOR, INDIANA.

This district is in the charge of Maj. William Ludlow, Corps of Engineers. The works on the eastern coast of Lake Michigan were in his charge the entire year; those in eastern Michigan were in the charge of Col. O. M. Poe, Corps of Engineers, to November 1, 1892, and of Maj. Ludlow since that date. Division Engineer, Col. O. M. Poe, Corps of Engineers.

1. Michigan City Harbor, Indiana.—The works at this harbor consist of—

a. The "inner harbor" made by deepening Trail Creek to 13 feet, and protecting the entrance by piers 100 feet apart and extending into the lake about 800 feet. The United States do the dredging and pier work, and the local authorities and shore-owners attend to revetting the banks. This work is completed except that an extension of the improvement to unoccupied territory in rear of the city has not yet been done.

The total expenditure to account of this work to July 1, 1892, was $105,923.06.

b. The "outer harbor," a basin of 40 acres built in the lake, inclosed by a pier on the east side and a breakwater, 1,400 feet long, on the north, and with an opening at the northwest angle. A northward

extension of the west pier closes the west side. This work was projected in 1870 and completed in 1884. The older works are much decayed, and the basin has never been dredged. It is not used by vessels.

In connection with the outer harbor, a pier projects 500 feet northward from the west end of the breakwater to protect the entrance from a strong westerly current.

The approximate cost of the outer harbor, as constructed, has been $560,000.

c. The "outer breakwater," projected in 1882 and now under construction. The work lies in the open lake westward of the entrance and is to have a length of 2,000 feet, the two equal arms making an angle of 135°. It is probable that some modifications of the plan and position of this work are desirable. Five hundred feet of it, starting from the east end, which is 400 feet distant from the end of the projecting breakwater pier, was built in 1889, and 200 feet more is now under contract.

Outer harbor.—The gross expenditure to account of the outer harbor to July 1, 1892, including the outer breakwater, was $706,588.05.

For the outer harbor the expenditures for the fiscal year were $6,830.41. The repairs to the west end of the old breakwater, begun in May, 1892, were completed in September, and the two outer cribs of the breakwater pier were refilled with stone and planked over.

On the outer breakwater some of the decking, broken by the heavy sea of the fall gales, was replaced.

The estimate for 1895, $80,000, is for continuing construction of outer breakwater 500 feet, with contingencies.

July 1, 1892, balance unexpended		$15,286.05
Amount appropriated by act approved July 13, 1892		30,000.00
		45,286.05
June 30, 1893, amount expended during fiscal year		6,830.41
July 1, 1893, balance unexpended		38,455.64
July 1, 1893, outstanding liabilities	$253.20	
July 1, 1893, amount covered by uncompleted contracts	24,669.22	
		24,922.42
July 1, 1893, balance available		13,533.22
Amount (estimated) required for completion of existing project		249,613.50
Amount that can be profitably expended in fiscal year ending June 30, 1895		80,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Inner harbor.—For the inner harbor, the expenditures for the fiscal year were $9,495.92. At the beginning of the year the navigation was in good condition and work continued on the inward extension, the area dredged being 1,430 feet long by from 50 to 100 feet wide, to a depth of 15 feet, and the amount handled 62,280 cubic yards. Soundings December 1, 1892, showed 18 feet at the entrance, 14 feet to the Franklin Street Bridge, and thence 12 and 13 feet to the upper end. In April, 1893, the entrance had shoaled to 11 and 12 feet, and a cut 75 feet wide by 16 feet deep was made for a distance of 625 feet. With additional dredging near the Michigan Central Railway Bridge, the total amount was 8,087 cubic yards. This left the navigation in good condition and the dredge cleaned out the lower winding basin at the expense of the city, the filling being due to silt from a sewer.

Aside from the dredging, the principal matter requiring attention is the old pier at the east side of the entrance. The outer 700 feet of this

is rapidly rotting down and the end has disappeared under water. It is a danger to vessels, and is needed to protect the entrance from the large accumulations of sand in the adjacent "outer harbor," and should be rebuilt to a height of about 4 feet above water.

The working balance on hand will be used for further dredging.

As the inner harbor is separately appropriated for, the estimate for 1895 is as follows: Rebuilding east pier, $8,000; refilling and minor repairs to west pier, $2,000; dredging for the maintenance of navigation, $4,000, which, with contingencies, makes $18,000.

July 1, 1892, balance unexpended	$3,451.94
Amount appropriated by act approved July 13, 1892	15,000.00
	18,451.94
June 30, 1893, amount expended during fiscal year	9,496.92
July 1, 1893, balance unexpended	8,956.02
July 1, 1893, outstanding liabilities	47.16
July 1, 1893, balance available	8,908.86
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	18,000.00

(See Appendix M M 1.)

2. St. Joseph Harbor, Michigan.—St. Joseph is one of the more important harbors of the east shore, with three lines of railway, and an extensive freight and passenger business by water, for the conduct and development of which the navigation facilities are with difficulty maintained by frequent dredging.

In its original condition the entrance had merely a variable channel of 3 to 7 feet. In 1836, owing to certain natural advantages of position and local features, it was selected for improvement as a harbor of refuge, and the project of 1866, modified in 1874 and 1875, called for a navigable depth of 16 feet and width of 270 feet. The project has never been carried out so far as the depth is concerned, the best water attained being 15 feet which of late years has not averaged more than 14 feet. In fact the failure to prolong the piers to an adequate depth in the lake and the formidable shoaling outside the entrance, due to accumulations against the north pier, have at times threatened to close the entrance altogether for the class of vessels using it. A special report of these conditions was made in November, 1891, with the recommendation that the north pier be extended as rapidly as practicable to the 15-foot contour in the lake, a distance of some 1,200 feet.

The present projection of the north pier beyond the shore line is 635 feet, and at the worst condition a shoal formed directly in front of the pier with only 7½ feet on it.

The interior navigation has been taken care of by frequent dredging, the points giving most difficulty being where the Paw Paw River discharges into the Benton Harbor Canal, and near the lower end of the so-called "wing dam," where the outflow from the St. Joseph River expands into the harbor area proper.

Both streams transport at times large amounts of sediment. In the case of the Paw Paw, a radical cure for the recurring obstruction can be secured by closing its present mouth in the canal and cutting another through the marsh into the head of the harbor back of the "wing dam." The banks of the canal should be properly revetted to protect the narrow and thronged fairway.

The total expenditures to July 1, 1892, were $272,831.29 and for the fiscal year $11,692.

During the season of 1892 extensive dredging was done inside the harbor, particularly above the railway bridge, where the spring freshets had made deposits reducing the channel depth to 10 feet.

In the fall the outer bar again gave trouble. On October 31 the depth was 11 feet only. This was deepened, notwithstanding the late and stormy season, by using every hour of smooth lake, working at night when practicable. When work was closed the depth on the bar was 16 and inside not less than 13 feet. The total dredged was 65,267 cubic yards.

Late in March, 1893, it was found that a bar with but 4 feet on it blocked the canal at the mouth of the Paw Paw. This was dredged down in April, as also a shoal above and through the railway bridge, where the depth was 11 feet only. From April 1 to July 1, 1893, 23,777 cubic yards was removed, and the outer bar showed 15 feet and the interior navigation 13, except at the lower end of the wing dam, where the depth was 11.7 feet.

Repairs were made November, 1892, of a break in the channel wall of the old north pier, but this portion of the work is in bad condition and must be rebuilt.

In December, 1892, a contract was made for 350 feet extension of the north pier and work began in April and has continued. Four cribs are partly completed and one ready to sink.

The working balance of $12,000, July 1, 1893, is held for the large amount of dredging required and to make minor repairs.

The estimates for 1895 are, for 850 feet of pier, $85,000; rebuilding part of the old north pier, $5,000; sheet piling, repairs, and refilling, $11,000. Total, with contingencies, $111,000.

July 1, 1892, balance unexpended		$1,280.91
Amount appropriated by act approved July 13, 1892		*60,000.00
		61,280.91
June 30, 1893, amount expended during fiscal year		11,692.00
July 1, 1893, balance unexpended		49,588.91
July 1, 1893, outstanding liabilities	$804.29	
July 1, 1893, amount covered by uncompleted contracts	36,697.39	
		37,501.68
July 1, 1893, balance available		12,087.23
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		111,000.00

(See Appendix M M 2.)

3. St. Joseph River, Michigan.—The improvement in question covers a distance of 25 miles from St. Joseph to Berrien Springs, and this was to be effected by the project of March, 1889, to the extent of securing 3 or 4 feet depth by the removal of snags and bowlders, and the building of small wing dams of cheap construction.

The results have been satisfactory to the limited commerce interested, but are not likely to be permanent without further measures.

The allotment of $1,000 from the appropriation for St. Joseph Harbor of July 13, 1892, was held to await further requirements, and at the close of the fiscal year the condition of the navigation was such as

*$1,000 of this sum is to be expended on St. Joseph River.

to call for its expenditure. The amount will be expended as heretofore, in building rough wing dams, removing snags, etc.

The total expenditures to July 1, 1892, were $3,450.27. No expenditures were made during the fiscal year.

If the work is to be continued, $2,000 additional should be appropriated, preferably independent of the appropriation for St. Joseph Harbor, which has great need of the full appropriation made for it.

July 1, 1892, balance unexpended	$49.73
Amount allotted under act approved July 13, 1892	1,000.00
	1,049.73
July 1, 1893, balance unexpended	1,049.73
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	2,000.00

(See Appendix M M 3.)

4. South Haven Harbor, Michigan.—The harbor is at the mouth of Black River, a stream of moderate dimensions, where the original expenditure at private cost had secured 6 or 7 feet, with a width of 85 feet.

The project of 1866, modified in 1869, 1872, and 1888, called for 12 feet, with a width of 180 feet between piers, the improvement to extend half a mile up stream to the highway bridge.

The piers lack 150 and 200 feet of the projected length and do not extend beyond the 10-foot contour in the lake, with the 15-foot contour 300 feet farther out. In consequence of this, frequent dredging is necessary, both on a recurring bar outside the piers and in the river where the naked banks permit such a silt to fill the channel.

The total expenditure to July 1, 1892, was $203,872.45, and for the fiscal year, $6,562.87.

In October, 1892, the bar was dredged 70 feet wide and 18 feet deep, and a cut made inside, taking out a total of 9,063 cubic yards, but by November 25 all traces of the work had disappeared, and but 10 feet practicable depth remained.

In April, 1893, there was but 9 feet for a distance of 1,300 feet, but the bar had 12 feet. The dredge worked again in May, taking out 15,690 cubic yards and restoring the navigation.

Considerable repairs were made during the year, rebuilding old work, refilling, etc., and this work is still in progress.

The estimate for 1895 is, for extending piers to complete the existing project, $42,000; for general repairs and dredging, 7,000; which, with contingencies, makes $54,000.

July 1, 1892, balance unexpended	$3,127.55
Amount appropriated by act approved July 13, 1892	10,000.00
	13,127.55
June 30, 1893, amount expended during fiscal year	6,562.87
July 1, 1893, balance unexpended	6,564.68
July 1, 1893, outstanding liabilities	2,325.64
July 1, 1893, balance available	4,239.04
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	54,000.00

(See Appendix M M 4.)

5. Saugatuck Harbor, Michigan.—The mouth of the Kalamazoo River has a natural depth in ordinary condition of 6 or 7 feet, and the project

of 1869, revised in 1875 and 1882, proposed to deepen this to 12 feet and extend the entrance piers into the lake 200 feet apart. The works have never been completed and are now for the greater part in a ruinous condition, while from the immense accessions of sand from the naked waste bordering the river on the north and the absence of proper protection the depth has not been increased to exceed 8 feet, with 10 feet as an exceptional and temporary feature. The river is an outlet for a considerable traffic during the fruit season even with all its disadvantages, but for several years past the Government aid has been confined to dredging when the navigation became entirely obstructed.

The dredge worked on the bar and river for four months in 1892, removing 36,050 cubic yards; but in May, 1893, there was again but 6 and 5 feet, and at the urgent request of local interests the dredge was sent there again in June, and is still at work.

The total expenditures to July 1, 1892, were $139,094.25, and for the fiscal year $4,076.73.

The estimates for 1895 are for partly rebuilding the south pier to save it from entire loss, $18,000, and for dredging, $5,000, which with contingencies makes $25,000.

July 1, 1892, balance unexpended	$1,344.75
Amount appropriated by act approved July 13, 1892	5,000.00
	6,344.75
June 30, 1893, amount expended during fiscal year	4,076.73
July 1, 1893, balance unexpended	2,268.02
July 1, 1893, outstanding liabilities	509.33
July 1, 1893, balance available	1,758.69
Amount (estimated) required for completion of existing project	30,260.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 5.)

6. Holland (Black Lake) Harbor, Michigan.—The outlet from Holland Lake was originally improved to about 5 feet at local expense and the project of 1866, amended in 1873, 1879, and 1884, calls for a 12-foot channel between piers and revetments 200 feet apart.

To secure this depth the piers have insufficient development, and frequent dredging is resorted to to keep the harbor open.

The piers are respectively 713 and 696 feet long, terminating at about the 10-foot contour in the lake, while the 15-foot contour is about 500 feet farther out, and the commercial interests of the harbor are hampered by insufficiency of depth.

August, 1892, the draft was 9 feet, September 8½ feet, and November 6½ feet. In April, 1893, soundings showed but 7 feet between the piers, notwithstanding the rise in the lake.

The entrance was dredged in April and June, 1893, and a cut 50 feet wide and 1,440 feet long made to 18 feet. The total dredged was 15,587 cubic yards, and by July 1 the navigable depth throughout was 13 feet, which, however, can not be maintained.

The total expenditures to July 1, 1892, were $272,242.87, and for the fiscal year $2,377.20.

The estimate for 1895 is: For sheet piling to prevent seepage of sand, $7,460, and for general repairs, refilling, etc., $6,000, which with contingencies makes $15,000.

July 1, 1892, balance unexpended	$2,371.25
Amount appropriated by act approved July 13, 1892	5,000.00
	7,371.25
June 30, 1893, amount expended during fiscal year	2,377.20
July 1, 1893, balance unexpended	4,994.05
July 1, 1893, outstanding liabilities	726.52
July 1, 1893, balance available	4,267.53
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	15,000.00

(See Appendix M M 6.)

7. Grand Haven Harbor, Michigan.—Grand Haven, lying at the mouth of Grand River, in addition to its local commerce as the terminal of the Detroit, Grand Haven and Milwaukee Railway, with which a line of trans-lake steamers connects, is the principal harbor of refuge on the coast, and with that object was designed with an entrance width of 400 feet and depth of 18 feet.

The mouth of the river was originally improved by the construction of a railway pier on the south side, and the work was taken in hand in 1866 with extensions authorized in 1880 and 1890.

Two great piers have been built, which, with the shore revetments, are respectively 3,187 and 5,576 feet in length. The outer ends of the piers are abreast each other, a position which, at Grand Haven, experience has shown to be most advantageous to the navigation. The works have secured very beneficial results, but there are still two matters of importance to be attended to. One the extension of the piers to their full length, of which 150 feet on the north and 100 feet on the south side are still lacking. The other is the control of the flying sand from the enormous dunes on the north side of the entrance, from which immense quantities of sand are annually blown into the river and, being carried down by the current, tend to maintain a bar directly opposite the middle of the entrance and outside the piers.

These dunes were originally covered with forest, but this was cut down and the surface left naked to dry and move with the wind. The work of regulating them by inducing natural growth of suitable vegetation is one requiring time and should not be deferred, as unless it is done the bar formation will continue, no matter to what length the piers extend.

It may be noted that this sand movement constitutes a vicious circle. The sands carried to the lake are then distributed and in part driven to the beach by wave and wind action, thence they climb the dunes, and, overlapping them, descend the slope to the river to be again transported to the lake. With vegetation on the dunes this circulation would cease.

The total expenditures to July 1, 1892, were $604,240.82, and for the fiscal year $33,959.38.

The navigation has been fairly satisfactory throughout the year, although in March, 1893, a prolonged flood in the river carried down a vast amount of sand, which reduced the entrance depth to less than 15 feet. By the end of March the sand wave had rolled out and the navigation improved. By June 13 there was again 17 feet at the entrance, with 15.9 feet on the bar outside.

The same spring flood seriously endangered a large portion of the curved revetment on the south side of the river, which regulates the

movement along the bend in the river inside the piers. The bottom was deeply scoured, leaving much of the front piling without support in the bottom, making necessary immediate measures to secure it. Arrangements had already been made for extensive repairs to the work, and these are still in hand.

The new 100 by 30 foot crib under contract was completed September, 1892, and in December further contract was made for 350 feet of north pier and 200 feet of the south pier. Work began in May, but progress has been slow.

In addition to completing the pier, extensive repairs to the old work are required. The estimate for 1895 is, to complete both piers, $35,000; to extend the north revetment upstream, $15,000; for rebuilding, repairing, refilling, etc., old work, $42,000; for dredging, sand fencing, and shrub planting, $12,000; total, with contingencies, $115,000.

July 1, 1892, balance unexpended		$20,125.33
Amount appropriated by act approved July 13, 1892		90,000.00
		110,125.33
June 30, 1893, amount expended during fiscal year		33,959.38
July 1, 1893, balance unexpended		76,165.95
July 1, 1893, outstanding liabilities	$830.91	
July 1, 1893, amount covered by uncompleted contracts	58,601.95	
		59,432.86
July 1, 1893, balance available		16,733.09
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		115,000.00

(See Appendix M M 7.)

8. Muskegon Harbor, Michigan.—Muskegon is the largest of the interior lakes which are scattered along the east shore of Lake Michigan. The river of the same name discharges through it, and the city of Muskegon, with a population of over 30,000, is built on its shores. With these advantages, three lines of railway, and numerous steamers, the harbor is an important one and its commerce large.

The entrance was originally deepened, at private cost, to about 7 feet. The project of 1866, amended in 1869, 1873, 1881, and 1884, called for a 13-foot channel with an entrance width of 300 feet. The revision of 1890 was to close a gap in the north pier and that of 1892 to deepen the navagation to 15 feet, through from lake to lake, and extend both piers 800 feet. With the increasing draft of lake vessels, the necessity becomes the greater to maintain a safe navigable depth at the entrances to all the important harbors if the needs of commerce are to be met.

For this purpose the piers must reach a depth in the lake greater than that to be maintained between them, the banks of the channel inside the piers should be revetted to prevent inflow of sand to the channel, and from time to time dredging is necessary to remove shoals due to drift from the lake shores and bed.

The total expenditures to July 1, 1892, were $317,796.53.

The piers are respectively 1,544 and 1,180 feet in length and need 800 feet to complete them, of which 250 and 300 feet are now under contract, leaving 550 and 500 feet to be appropriated for.

The expenditures for the fiscal year were $15,567.17.

The navigation has been fairly maintained, but at the end of April, 1893, there was only 11.8 feet near the entrance, and dredging was imperative. The United States plant being engaged elsewhere, a con-

tractor's dredge was employed, and, beginning work May 18, by June 30 had removed 13,855 cubic yards, making a cut 1,000 feet long, 75 feet wide, to a depth of 18 feet. The work will be completed early in July.

Repairs to the revetments were made October to December, 1892, and the work should be continued.

During June, 1893, three of the contract cribs were sunk in place, two on the north and one on the south pier, leaving three more to be placed.

The estimate for 1895 is for pier extension, to complete the project, $126,000; and for stone filling, sheet piling, repairs, and dredging, $13,520, which with contingencies makes $154,000.

July 1, 1892, balance unexpended		$11,203.47
Amount appropriated by act approved July 13, 1892		75,000.00
		86,203.47
June 30, 1893, amount expended during fiscal year		15,567.17
July 1, 1893, balance unexpended		70,636.30
July 1, 1893, outstanding liabilities	$623.50	
July 1, 1893, amount covered by uncompleted contracts	54,014.14	
		54,637.64
July 1, 1893, balance available		15,998.66
Amount that can be profitably expended in fiscal year ending June 30, 1895		154,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix M M 8.)

9. White Lake Harbor, Michigan.—White Lake is a broad and capacious body of water, the outlet of which was originally improved at local expense to about 5 feet.

The project of 1866 is to increase this to 12 feet, with an entrance width between piers and revetments of 200 feet. The full depth proposed has never been attained. The piers lack 200 and 250 feet respectively of the projected length, and to reach the 15-foot contour should extend about as far again.

The outer crib of the south pier has for some years been settling into the lake, and a new crib outside is required to sustain it. Large amounts of sand pass around the end of the north pier, which terminates at about the 8-foot contour in the lake, and repeated dredging is needed to remove the deposits in the entrance. The pier should be extended to its full length, but only 150 feet is estimated for at this time.

The expenditures to July 1, 1892, were $262,914.18, and for the fiscal year, $9,241.45.

The extensive repairs to piers and revetments, begun in June, 1892, were continued until the end of November, closing gaps, refilling piers, renewing decking, sheet piling to prevent seepage of sand into the channel, and rebuilding rotten superstructure. A considerable further amount of repairing is needed, as some of the work over twenty years old is approaching its limit of endurance.

In May, 1893, there was but 10.5 feet in the entrance channel, and a dredge will be sent there.

The balance unexpended July 1, 1893, is held for necessary dredging and minor repairs.

The estimate for 1895 is for 150 feet of new north pier and 100 feet of new south pier, $28,000; for rebuilding 367 feet of south pier above water, $3,670; total, with contingencies, $35,000.

July 1, 1892, balance unexpended	$11,635.82
Amount appropriated by act approved July 13, 1892	5,000.00
	16,635.82
June 30, 1893, amount expended during fiscal year	9,241.45
July 1, 1893, balance unexpended	7,394.37
July 1, 1893, outstanding liabilities	439.31
July 1, 1893, balance available	6,955.06
Amount (estimated) required for completion of existing project	43,225.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	35,000.00

(See Appendix M M 9.)

10. Pentwater Harbor, Michigan.—Pentwater is one of the smaller of the interior lakes along the west Michigan coast, and its entrance was originally a mere drain, later improved to about 4 feet by slab piers built by private interests.

The project of 1866, amended in 1873 and 1884, calls for 12 feet depth between piers and revetments 150 feet apart. The south pier still lacks 200 feet of its projected length and should be completed, as the outer ends of the piers only reach the 10-foot contour in the lake, and the 15-foot contour is 400 feet farther out. Meanwhile the navigation is kept at about 10 feet by occasional dredging.

The total expenditure to July 1, 1892, was $231,393.89, and for the fiscal year $973.38.

In July, 1892, the channel depth had diminished to 9 feet and was restored in July and August by a cut 40 feet wide, 15 to 16 feet deep, reaching from 13 feet inside to deeper water at the ends of the piers. The material removed measured 11,674 cubic yards. By November the entrance had again shoaled to 10 feet, but this held during the winter and in May, 1893, was 11.3 feet, the lake having risen a foot or more.

The balance unexpended July 1, 1893, is reserved for necessary dredging and minor repairs.

Much of the older work is badly dilapidated, and especially the inner revetments which are in urgent need of repair.

The estimate for 1895 is for 200 feet of south pier to complete the project, $24,000; for rebuilding and refilling with stone 1,557 feet of old revetment, $15,570; for dredging, $3,000, making, with contingencies, $45,000.

July 1, 1892, balance unexpended	$2,426.11
Amount appropriated by act approved July 13, 1892	5,000.00
	7,426.11
June 30, 1893, amount expended during fiscal year	973.38
July 1, 1893, balance unexpended	6,452.73
July 1, 1893, outstanding liabilities	280.13
July 1, 1893, balance available	6,172.60
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	45,000.00

(See Appendix M M 10.)

11. Ludington Harbor, Michigan.—Ludington is a terminal of the Flint and Pere Marquette Railway, and steamer service is maintained throughout the year, with heavy shipments of salt and receipts of flour and wheat.

The inner harbor is Pere Marquette Lake, on which the city is built. The natural outlet had about 6 feet of water. The project of 1867 called for 12 feet, with an entrance width between piers and revetments of 200 feet. In 1885, the scope of the project was enlarged in order to create a "harbor of refuge" for general lake commerce, with width of 400 feet and channel depth of 18 feet. In 1890, however, local circumstances indicated a preferable retention of the original width.

The harbor works, as completed in 1890, have a total length of 1,450 and 2,300 feet, respectively, the south pier being 350 feet the longer; while generally in good and effective condition much of the older work is in need of repair.

With occasional dredging to remove deposits between the piers, a satisfactory navigation of from 14 to 16 feet is maintained.

The total expenditures to July 1, 1892, were $349,216.57 and for the fiscal year, $758.44.

The channel depth continued at about 14.5 feet during the season of 1892. In November, 13.6 feet was found, but in June, 1893, the least channel depth was 14.5 feet, the lake having risen a foot.

The dredge began work June 25 to widen and deepen the fairway and by July 1 had taken out 4,858 cubic yards.

The stone filling in the outer portion of the south pier having settled considerably, provision was made for refilling it. The cribs are provided with partly open bottoms, in order that as erosion of the lake bed may take place from the action of the waves and currents the stone ballast shall pass down and maintain the solidity of the work upon the aggregate mass of which its service and security depend.

The estimate for 1895 is as follows: Rebuilding two sections of north pier, $8,470, and two sections of south pier, $13,100; general repairs and filling, $5,000; dredging, $4,000; which, with contingencies, makes $34,000.

July 1, 1892, balance unexpended	$3,217.53
Amount appropriated by act approved July 13, 1892	5,000.00
	8,217.53
June 30, 1893, amount expended during fiscal year	758.44
July 1, 1893, balance unexpended	7,459.09
July 1, 1893, outstanding liabilities	671.58
July 1, 1893, balance available	6,787.51
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	34,000.00

(See Appendix M M 11.)

12. Manistee Harbor, Michigan.—The commerce of Manistee is large and is maintained throughout the year, the Flint and Pere Marquette Railway Company having a terminal here, as well as at Ludington, and the salt and lumber shipments are heavy.

Manistee River enters the lake of same name and thence flows to Lake Michigan about 8,000 feet distant.

As originally deepened by lumber industries, the entrance had 7 or 8 feet of water. The project of 1867, revised in 1871, 1873, and 1875, called for 12 feet between piers 180 feet apart. As again revised in 1890, the depth was to be increased to 15 feet and the improvement to extend through the river from lake to lake, the natural depth being from 10 to 11 feet only. The work was done in 1891, but in May, 1892, the river channel had shoaled to 13 feet, owing to the narrowness of

the stream, the unprotected state of the banks, and the large number of vessels passing. The act of July 13, 1892, took cognizance of this and provided that further dredging in the river should be contingent on proper bank protection.

The entrance piers have a length of 1,251 feet and 1,129 feet, respectively, with 350 feet of extension required for each. Much of the older work is in need of repair.

The total expenditures to July, 1892, were $222,669.31, and for the fiscal year $9,440.84. The outer north cribs, needing ballast, were refilled and riprapped. Contract was made December, 1892, for 350 feet of pier on the north side to complete it. The work is in progress and will be completed this season, the first crib having been sunk June 23.

In May, 1893, repairs were begun on the portions of older work most in need of them, and continued to the end of the year, cutting down and rebuilding, overhauling, filling, removing broken timber and closing gaps.

The navigation was fairly good during 1892, but this spring further dredging was required, which was done in May and June, making a cut 60 feet wide and 18 feet deep for a distance of 980 feet. Between the piers a 13-foot shoal was deepened to 18 feet with a width of 80 feet. The total amount dredged was 24,970 cubic yards.

The south pier should be completed by building an additional 350 feet and the repairs continued.

The estimate for 1895 is: To complete the south pier, $42,000; for repairs and sheet piling, $9,300, and for dredging, $4,000; total, with contingencies, $61,000.

July 1, 1892, balance unexpended		$5,330.69
Amount appropriated by act approved July 13, 1892		50,000.00
		55,330.69
June 30, 1893, amount expended during fiscal year		9,440.84
July 1, 1893, balance unexpended		45,889.85
July 1, 1893, outstanding liabilities	$1,472.02	
July 1, 1893, amount covered by uncompleted contracts	29,863.34	
		31,335.36
July 1, 1893, balance available		14,554.49
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		61,000.00

(See Appendix M M 12.)

13. Harbor of refuge at Portage Lake, Manistee County, Mich.—There is but one harbor of refuge on the eastern shore of Lake Michigan, that at Grand Haven, and another is needed in the north middle section of the lake. Portage Lake was adopted in 1879 as a favorable location and the project of that date, modified in 1880 and 1881, provided for an entrance depth of 18 feet and width of 370.

The appropriations made for this purpose have been so disproportionate that no practical result has been attained. The entrance is choked with sand and the half-built piers are almost in ruins. The navigable depth is only from 7 to 9 feet.

The total expenditures to July 1, 1892, were $95,055.92, and for the fiscal year, $1,558.69.

The entrance was dredged in June, 1892, to 13 feet, which gradually diminished to 8½ feet at the end of the season. June, 1893, the depth was 8.8 feet.

If the work is to be carried to completion, adequate appropriations should be made, and with this object the estimate for 1895 is: For extending pier, $55,000; for rebuilding old pier, $38,000; dredging, $10,000, and minor items, $6,400, making with contingencies $125,000.

July 1, 1892, balance unexpended	$5,444.08
June 30, 1893, amount expended during fiscal year	1,558.69
July 1, 1893, balance unexpended	3,885.39
July 1, 1893, outstanding liabilities	207.25
July 1, 1893, balance available	3,678.14
Amount (estimated) required for completion of existing project	167,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	125,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 13.)

14. Frankfort Harbor, Michigan.—Lake Aux Becs Scies formerly discharged into Lake Michigan through a channel of 3 or 4 feet, and the project of 1866, revised in 1869 and 1879, called for an entrance depth of 12 feet and width of 200 feet.

The project is not yet completed, and by annual dredging from 9 to 11 feet is provided. The north pier lacks 300 feet of completion and the south pier 100 feet, and provision is needed for this, especially in view of the fact that the Toledo, Ann Arbor and North Michigan Railway, having a terminal at Frankfort, has undertaken a costly and interesting experiment in ferrying freight trains across the lake to Kewaunee, a distance of 62 miles. The two transfer boats, specially built for the purpose, were put in service in midwinter, and thereafter made regular trips, establishing the feasibility of the undertaking.

In September, 1892, dredging began at Frankfort, under contract, and was continued until November 30. The quantity removed was 37,106 cubic yards, making a cut 100 feet wide and 16 feet deep.

In April, 1893, the depth was still sufficient for navigation, and the contract was closed. Soundings in June showed a navigable depth of 16 feet, indicating an unusual and unexpected tendency to continuance, but further dredging will no doubt be called for during the season.

The total expenditures to July 1, 1892, were $263,511.86 and for the fiscal year $6,595.36.

The estimate for 1895 is: To complete the piers, according to present project, $40,500; for sheet piling, repairs, and dredging, $5,000, which with contingencies makes $50,000.

July 1, 1892, balance unexpended	$4,426.49
Amount appropriated by act approved July 13, 1892	10,000.00
	14,426.49
June 30, 1893, amount expended during fiscal year	6,595.36
July 1, 1893, balance unexpended	7,831.13
July 1, 1893, outstanding liabilities	13.00
July 1, 1893, balance available	7,818.13
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 14.)

15. Charlevoix Harbor and entrance to Pine Lake, Michigan.—The harbor of Charlevoix penetrates the peninsula between Great and Little

Traverse bays, and furnishes access to Round and Pine lakes. The original entrance depth, due to the outflow from these lakes, was from 2 to 6 feet. The project of 1868, revised in 1876, calls for 12 feet between piers 100 to 150 feet apart at the Lake Michigan entrance, and the revetment of a passage 83 feet in width between Round and Pine lakes.

The expenditures to July 1, 1892, were $99,944.24. The piers are not yet fully extended, and the navigation is irregularly maintained by dredging, at from 10 to 11 feet. The conditions this spring are unusually good, due to the rise in the lake level, not less than 13 feet of water showing in the channel axis.

The south pier needs completion by the addition of 100 feet, and much of the older work should be repaired.

The expenditures for the fiscal year were $2,123.67.

Both the channels were dredged in July, 1892, the lower 70 feet wide and 16 feet deep and the upper 40 feet wide and 13 feet deep. The material dredged measured 14,105 cubic yards, which was dumped in the outer lake.

With the balance unexpended July, 1893, certain urgent repairs, already estimated for, will be made and the channel dredged as shall be required.

The estimate for 1895 is: For 100 linear feet of south pier, to complete the project, $9,500; rebuilding 500 feet of old north pier and sheet piling and strengthening the revetments and dredging, $28,500, making with contingencies $42,000.

July 1, 1892, balance unexpended	$2,555.76
Amount appropriated by act approved July 13, 1892	10,000.00
	12,555.76
June 30, 1893, amount expended during fiscal year	2,123.67
July 1, 1893, balance unexpended	10,432.09
July 1, 1893, outstanding liabilities	87.89
July 1, 1893, balance available	10,344.20
Amount (estimated) required for completion of existing project	73,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	42,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 15.)

16. Petoskey Harbor, Michigan.—Petoskey lies on the south shore of Little Traverse Bay. Its water front is without anchorage, and a landing pier extending into the bay is exposed to heavy seas from north and northwest winds. Pursuant to the act of August 11, 1888, two projects had been submitted for furnishing shelter to shipping in that locality, one to construct a harbor in the bay by means of a pier projecting offshore from a point westward of the city and connecting with a breakwater extending eastwardly and covering the city front.

The sheltered area would be about 12 acres and vessels would lie in safety in any part of it, including the landing pier.

The estimated cost of the work was $170,000.

The alternative project was to rebuild and extend the landing pier itself with an L or arm to the eastward, so that vessels could safely lie in the angle. The estimated cost was $70,000.

The act of September 19, 1890, appropriated $15,000 toward the construction of the breakwater project, and as the expenditure of this

amount would accomplish no useful result, further action by Congress was awaited.

The act of July 13, 1892, appropriated $20,000 more, but provided that this and the previous sum should be expended on the landing pier project.

The citizens of Petoskey and the interests concerned, preferring the larger project, which would be of much greater value to them, asked that action be deferred until Congress could be again memorialized on the subject. In the case of either project an additional appropriation of $35,000 is needed; if for the landing pier, in order that the entire work could be completed in one season, and if for the breakwater, in order that the shore pier, 550 feet long and not less than 350 feet of the total 1,200 feet of the breakwater proper, could be put under one contract.

July 1, 1892, balance unexpended	$15,000.00
Amount appropriated by act approved July 13, 1892	20,000.00
	35,000.00
June 30, 1893, amount expended during fiscal year	219.20
July 1, 1893, balance unexpended	34,780.80
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	35,000.00

(See Appendix M M 16.)

17. Cheboygan Harbor, Michigan.—Prior to improvement, the natural entrance depth into Cheboygan River did not exceed 7 feet, and the project of 1871 called for a depth of 13 feet and width of 200 feet, extending to the 14-foot contour in the bay. It was also provided that the banks of the cut be protected with pile piers, but as the work progressed it was found that owing to tenacious material through which the channel was dredged the protection piers could be dispensed with and their entire cost saved.

With the deepening of the navigation, too, the harbor rapidly grew into importance, and the construction of extensive lumber piers bordering the cut now constitutes solid revetments for nearly half its length. Subsequent modifications were made, until it now calls for a channel 200 feet wide and 15 feet deep from deep water in the bay as far as the State Road Bridge across the river, a total distance of 7,200 feet.

In November, 1889, the project, so far as the dredge-work was concerned for the area in question, was practically completed, leaving a balance of $18,000 standing to the credit of the work, the expenditure of which was deferred until such time as the deterioration of the channel depths should necessitate further dredging, and the construction of the protection piers should be shown to be desirable.

In October, 1892, the channel depths, from natural causes, in combination with the low stage of the lake, had diminished to 12 feet, and the officer in charge recommended that in lieu simply of restoring the 15-foot navigation the channel be dredged to afford 18 feet, which would not be in excess of the requirements of the lake commerce.

The total expenditures to July 1, 1892, were $129,702.32.

July 1, 1892, balance unexpended	$18,327.73
June 30, 1893, amount expended during fiscal year	130.05
July 1, 1893, balance unexpended	18,197.68

(See Appendix M M 17.)

18. Thunder Bay Harbor, Michigan.—Thunder Bay is an open roadstead, and the "harbor" is, in effect, the mouth of the river of the same name where the city of Alpena has been built.

Outside the mouth of the river, the original depth was 6 to 8 feet only, but both entrance and river channel were deepened at local cost to 12 feet, prior to the undertaking of the improvement by the United States.

The original project for the improvement was adopted in 1876 and provided for an entrance channel from the bay into the river of navigable width and not less than 13 feet depth. This was subsequently increased to 14 feet.

By 1884 the entrance channel had been made, but as was then stated the depth could not be regarded as permanent and would require attention from time to time in the future.

In 1889 the project was enlarged to provide for 16 feet, and the entrance was accordingly redredged to 14 feet with a width of 250 feet and a beginning made on deepening it to 16 feet, in order that the additional depth made in the river could be carried through the entrance.

The total expenditures to July 1, 1892, were $22,337.70. No specific appropriation for the entrance was made in the river and harbor act of July 13, 1892, but the deepening of the channel across the bar to 16 feet under the general project of 1889 will be continued under the contract of October 1, 1892, with H. W. Hubbell & Co.

As Thunder Bay river and harbor designate practically the same locality, "Alpena Harbor", an appropriation of $5,000 for the fiscal year 1895 is asked under that title for the maintenance of the navigation.

July 1, 1892, balance unexpended	$823.63
July 1, 1893, balance unexpended	823.63
July 1, 1893, amount covered by uncompleted contracts	823.63

(See Appendix M M 18.)

19. Alpena Harbor (Thunder Bay River), Michigan.—Thunder Bay River and Thunder Bay Harbor are practically the same locality, both being the harbor of Alpena, although at times separate appropriations have been made under the two designations.

A brief history of the work is given under the head of Thunder Bay Harbor.

Prior to improvement by the United States the entrance and lower portion of the river had been deepened to 12 feet at local cost. The original project of 1876 called for a depth of 13 feet, which was later increased to 14 feet, and in 1889 the project was enlarged to secure 16 feet, and to extend the improvement a mile up stream to the milldam with widths diminishing from 100 feet at the mouth to 50 feet at the upper limit.

The project has practically been completed, although the dredging at the upper end was terminated at seven-eighths of a mile by encountering rock in the bed of the stream. The total expenditures to July 1, 1892, were $8,720.30, and for the fiscal year, $1,838.67.

Contract was made October, 1892, with H. W. Hubbell & Co., to deepen the channel across the bar at the entrance to 16 feet and for such width as the funds will admit.

As the channel depth and width, both at the entrance and inside the mouth, are likely to deteriorate in time from the action of current and sea and the movement of vessels, an appropriation of $5,000 for

the maintenance of the navigation is estimated for 1895, under the common title "Alpena Harbor."

July 1, 1892, balance unexpended		$1,279.70
Amount appropriated by act approved July 13, 1892		10,000.00
		11,279.70
June 30, 1893, amount expended during fiscal year		1,838.67
July 1, 1893, balance unexpended		9,441.03
July 1, 1893, outstanding liabilities	$38.24	
July 1, 1893, amount covered by uncompleted contracts	4,396.37	
		4,434.61
July 1, 1893, balance available		5,006.42
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		5,000.00

(See Appendix M M 19.)

20. Saginaw River, Michigan.—The Saginaw River with its tributaries drains a territory of some 5,800 square miles and discharges northward into Saginaw Bay. The river proper has a length of about 22 miles, at which distance from the mouth the two main affluents, the Titibawassee and Shiawassee unite to form the main stream. The region has been enormously productive, especially of lumber and salt. The important cities of East and West Saginaw are built at the upper end of the river, and Bay City and smaller places farther down. The population and industries of the valley are large and the commerce extensive. The river has a large volume and at times a strong current.

Prior to improvement the entrance was obstructed by an extensive bar in Saginaw Bay about a mile from shore and a half a mile across between the 10-foot contours, with a minimum depth of 9 feet.

Between the mouth and Bay City, a distance of 5 miles, the depth varied from 15 to 30 feet. Thence to the head of the river the prevailing depth was from 12 to 20 feet, but with several bars with 7 feet only obstructing the channel and the division of the current by islands at certain points impairing its effect in maintaining the depth.

There was thus a natural capacity for a 12-foot navigation and the original project of 1866, at which time the improvement was begun, adopted this as a channel datum.

In 1882 a revision called for 14 feet from the bay to Bay City and thence upward 12 feet with a uniform width of 200 feet. As the improvement progressed various additions to and modifications of the project were made, in especial the construction and extension of heavy training walls with lighter revetments opposite them to regulate the current at Carrollton and at the head of Crow Island.

The work as so far completed has been attended with entirely satisfactory results to navigation, but the construction of dredged channels in a silt-bearing stream of such volume as the Saginaw, draining an extensive alluvial region in process of conversion from forest to farm and subject to freshets of great force and duration, involves charges very considerable in their total, quite other than those that could properly be included in the original estimate of cost. The maintenance of such a navigation involves expenditures, both while the work is in progress and subsequently, not properly chargeable to the construction

account and while these additional sums are of necessity paid out of the appropriations made they should not be charged against the estimates.

In the case of the Saginaw, the work has been in hand since 1866, and the officer in charge estimates that for the 22 miles of navigation, an annual expenditure of $5,000 would be a moderate allowance for the cost of maintenance, and according to this computation a large sum has been paid in the last twenty-six years for recurring and incidental charges not included in the estimates for construction, of which it is computed there still remains some 640,000 cubic yards to be disposed of in order to complete the project.

The total expenditures to July 1, 1892, were $555,132.31 and for the fiscal year, $33,479.58.

Under the appropriation of $100,000 in the act of July 13, 1892, work was carried on as follows:

1. On the bar outside the entrance. A contract in force at the beginning of the fiscal year was continued to July 12, and terminated. A new contract was made in October, 1892, under which work began May 29, 1893, and is still in progress. A supplementary contract, dated June 26, provides for deepening the bar to 16 feet instead of 14 feet, in order that the entrance depth, where vessels are exposed to the rise and fall of the sea, should be equivalent to the 14 feet provided in the smooth water in the river.

At the close of the year 15,728 cubic yards had been dredged, and fair progress made.

2. The Essexville Bar. The 1891 contractors who had been engaged on the bar in July, 1892, on the 12th moved to Essexville Bar and worked until the 21st. A new contract was made in October, 1892, and two dredges were employed to November 26, when the plant was laid up for the winter. Work was resumed with one dredge April 22, and completed May 27. The total removed was 43,371 cubic yards, making a channel 200 feet wide with a depth of 14 feet.

3. In October and November, 1892, 18,020 cubic yards was dredged from the west channel at West Bay City, making a serviceable navigation of 12 feet depth by 50 feet in width.

4. A small amount of work was done on Melbourne Bar in November, 1892, and continued in April, 1893, and a channel 100 feet wide by 12 feet deep would have been completed had not one of the two dredges engaged on the work been run into and sunk on June 12. Seventeen thousand two hundred and eighty-seven cubic yards was taken out. A cut 700 feet long is needed to complete the work as at present provided for.

In June, 1893, 5,410 cubic yards was taken out from the New York Works Bar, where a channel 12 feet deep is to be made and of such width by successive cuts as the allotment will permit.

In February, 1893, attention having been called to the development of a shoal in the vicinity of the McEwen Mill, Bay City, examinations were made through the ice. The soundings showed that with any increase the shoal would require attention, but thus far the good stage of river and increased general lake level has obviated the necessity for the present.

Renewed examinations will be made of the localities under treatment and of such others as shall be indicated as in need of observation.

The sum of $150,000 can be profitably expended in continuance of the general improvement of the river.

July 1, 1892, balance unexpended		$12,617.69
Amount appropriated by act approved July 13, 1892		100,000.00
		112,617.69
June 30, 1893, amount expended during fiscal year		33,479.58
July 1, 1893, balance unexpended		79,138.11
July 1, 1893, outstanding liabilities	$585.43	
July 1, 1893, amount covered by uncompleted contracts	59,317.32	
		59,902.75
July 1, 1893, balance available		19,235.36
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		150,000.00

(See Appendix M M 20.)

21. Harbor of refuge at Sand Beach, Lake Huron, Michigan.—The harbor of refuge at Sand Beach is the only place of shelter accessible to the general commerce of the lakes in the vicinity of Pointe aux Barques, Lake Huron, an exposed and stormy locality with no harbor or safe anchorage for a stretch of 80 miles along a rocky and dangerous coast.

The harbor was projected in 1876 at an estimated cost of $1,155,000 and practically completed in 1885 at a cost of about $975,000, although much excavation is still needed within the basin. The works are built in the open lake in a curvature of the shore line and furnish shelter from north, northeast, and east, the land sheltering from west and south. From southeast the harbor is exposed in part, but in this portion the outside depth is 10 feet and less and the seas can not enter with any force. The entrances are from the north with a width of 300 feet, and from the east with a width of 600 feet.

The piers are detached and three in number, the west pier 1,500 feet long facing about north by east, the main pier 4,672 feet long facing northeast; and the south pier 1,956 feet long facing east. The area inclosed having 12 feet depth and over is 300 acres, but with 15 feet only half this, and with 21 feet 90 acres only. The north entrance is seriously obstructed with foul, rocky bottom, and is therefore used hardly at all. The main entrance is freer, but has rocky shoals bordering it on the south side both in the lake and in the harbor, and the 21 feet area inside should be greatly enlarged in order that deep vessels plunging in a heavy sea should be in no danger of striking the rocky bottom.

Much of the timber work of the piers is now well advanced in age and in need of extensive repairs, for which purpose it is desirable to maintain an adequate working balance in hand in order that a casualty to the works should not from lack of means to amend it become a disaster.

Probably no other single work on the lakes has the peculiar relation in value to general commerce. Without local commerce it is at times thronged with vessels seeking shelter, and the statistics show the number and tonnage annually availing themselves in increasing measure of its protection, and its total cost has been inconsiderable in comparison with the advantages gained by shipping.

Contract was made with Dunbar & Sullivan March 27, 1893, for dredging the rocky bottom near the entrance, to the authorized amount of $60,000, and repairs estimated to cost $20,000 have also been provided for. The dredging work began June 30 and is in progress; the general repairs will be made during the present season.

There is at the end of the fiscal year a balance of about $100,000 to the credit of the harbor free of present outstanding obligations, but current expenses and minor repairs, amounting on the average to

$10,000 per annum, must be paid out of this sum; extensive repairs to the works and enlargement of the deeper areas are required, and there should always be an adequate sum on hand to meet emergencies.

An appropriation of $80,000 is therefore asked for the year 1895.

July 1, 1892, balance unexpended		$44,237.83
Amount appropriated by act approved July 13, 1892		150,000.00
		194,237.83
June 30, 1893, amount expended during fiscal year		13,424.15
July 1, 1893, balance unexpended		180,813.68
July 1, 1893, outstanding liabilities	$1,081.37	
July 1, 1893, amount covered by uncompleted contracts	67,784.16	
		68,865.53
July 1, 1893, balance available		111,948.15
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		80,000.00

(See Appendix M M 21.)

22. Black River at Port Huron, Michigan.—Black River discharges into the St. Clair River through the city of Port Huron, near the foot of Lake Huron, and is an important winter harbor for vessels owned at Port Huron and elsewhere.

Prior to improvement the lower one and a half miles from the mouth to the Grand Trunk Railway Bridge had a navigable depth of 10 feet, with occasional bars with 8½ or 9 feet only. The improvement of the river was begun in 1890 on the basis of a project calling for 16 feet, with a width at the entrance of 160 feet, diminishing to 75 feet at the upper limit. The cost of the work was estimated at $75,000. Dredging began in the spring of 1891 and was continued, with suspension during the winter, to August 31, 1892. On June 30, 1892, a distance had been covered of some 6,200 feet, with a width of 75 feet in the lower part and 50 feet above.

When the contract was closed, August 31, the entire distance to the Grand Trunk Railway Bridge had been covered, but the full width had not yet been attained.

A new contract was made under the act of July 13, 1892, but the contractors lost their plant on Lake Erie while en route to Port Huron in October, 1892, and being unable to secure other plant the contract was annulled for failure to begin as specified, viz, May 1, 1893. The work was again advertised and a new contract made, which is to go into effect July 1, 1893.

The total expenditures to July 1, 1892, were $10,625.50, and for the fiscal year $14,374.35. The current appropriation will probably suffice to complete the project as prescribed, but the dredged channel in so narrow a stream can not maintain its depth, and an estimate of $5,000 for maintenance is made for 1895.

July 1, 1892, balance unexpended		$14,374.50
Amount appropriated by act approved July 13, 1892		10,000.00
		24,374.50
June 30, 1893, amount expended during fiscal year		14,374.35
July 1, 1893, balance unexpended		10,000.15
July 1, 1893, outstanding liabilities	$417.11	
July 1, 1893, amount covered by uncompleted contracts	8,500.00	
		8,917.11
July 1, 1893, balance available		1,083.04

Amount (estimated) required for completion of existing project	$40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 22.)

23. Mouth of Black River, Michigan.—In the St. Clair River, opposite Port Huron and overlapping the mouth of Black River, is an extensive shoal called the "Middle Ground," which occupies two-thirds of the river width and borders the main channel which curves sharply around its eastern limit. The reduction of the shoal is important both to permit access to the Port Huron frontage and the mouth of Black River, and to relieve the general navigation from the danger due to the deep curvature in the channel and the powerful current of the river.

The shoal was dredged under appropriations made in 1872, 1873, 1874, 1875, and 1878 to 15 feet at a period when the general navigation was regulated by the depth on the St. Clair Flats, which was then 13 feet.

Further examination was made in 1886 and project adopted to redredge and deepen it to 16 feet, and this work has been completed during the fiscal year, with the addition of increasing the depth to 18 feet for a limited area on the eastern border of the shoal immediately adjacent to the main channel.

The shoal is derived from erosion of the banks and bed of the St. Clair below Port Huron by the powerful current of the river, reaching at times 7 miles per hour, and from detritus brought down in freshets by Black River, which discharges across the shoal. The entire area is reported as deepened to 16 feet, which, however, does not meet the present requirements of general lake navigation, and the shoal will no doubt reform, as the causes that produced it are still in full operation.

The total expenditures to July 1, 1892, were $76,958.70, and for the fiscal year $9,541.30.

An appropriation of $10,000 to provide for maintenance will be needed for fiscal year 1895.

July 1, 1892, balance unexpended	$192.72
Amount appropriated by act approved July 13, 1892	10,000.00
	10,192.72
June 30, 1893, amount expended during fiscal year	9,541.30
July 1, 1893, balance unexpended	651.42

Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix M M 23.)

24. Clinton River, Michigan.—The natural capacity of Clinton River is from 10 to 8 feet, with several bars and bends obstructing the navigation, but the entrance is across a flat with 3 or 4 feet only at the shallowest point and the 10-foot contour half a mile from shore. In 1870 an entrance channel was dredged 2,700 feet long, 100 feet wide, and 9 feet deep, but later filled again.

In 1880 a project for the general improvement of the river was made to extend to Mount Clemens, 8 miles up, the channel to be deepened to 8 feet and the bends straightened and held by dikes, the entrance to be deepened to 9 feet and protected by a pile dike extending off shore to the 10-foot contour. The total cost of the project as amended and

finally approved in 1889 was $32,926, on the basis of a continuous prosecution of the work to completion.

The river work proper has been completed, its cost being enhanced by much additional dredging due to the prolonging of the work over several seasons, involving charge for maintenance, not included in the original estimate.

The permanent improvement of the entrance is yet to be made. A brush mattress, covered with stone, was laid in 1882 for about half the whole length of the protection dike. For the maintenance of an entrance channel pending construction of the permanent works, repeated dredging was required that vessels might have access to the river, and the successive appropriations made have been depleted by charges of this kind, with the effect of postponing the building of the dike.

The appropriation of $8,564 in the act of July 13, 1892, completed the appropriation of the original estimate for construction.

The expenditures to July 1, 1892, were $51,398.48, and for the fiscal year $1,336.58.

Contract was made in October, 1892, for two sections of pile dike in training wall, aggregating 1,220 feet in length. The contractor began work May 20, 1893, and had completed the pile driving by July 1, 1893.

July 1, 1892, balance unexpended		$101.52
Amount appropriated by act approved July 13, 1892		8,564.00
		8,665.52
June 30, 1893, amount expended during fiscal year		1,336.58
July 1, 1893, balance unexpended		7,328.94
July 1, 1893, outstanding liabilities	$120.00	
July 1, 1893, amount covered by uncompleted contracts	6,453.01	
		6,573.01
July 1, 1893, balance available		755.93

(See Appendix M M 24.)

25. Rouge River, Michigan.—Rouge River is a small stream entering Detroit River at the southwestern limits of the city of Detroit. It has a good natural capacity with nearly uniform depths of 10 to 12 feet, and width of 175 feet.

The vicinity of Detroit, and the establishment of important industries on its banks, gives the navigation a certain commercial value, and the project adopted for its improvement in 1887 provides for dredging to a depth of 16 feet, with widths varying from 240 feet at the entrance from the Detroit River to 70 feet at the upper limit below the Wabash Railway Bridge, a distance of about 15,000 feet.

With the $20,000 appropriated by the river and harbor acts of 1888 and 1890, the dredging was carried about 13,000 feet upstream, leaving some 1,800 feet to be gone over between the two railway bridges at the upper end, with considerable widening to be done in the lower reaches.

Under the appropriation of $11,690, made in the act of July 13, 1892, the work was completed as projected, and some of the earlier cuts redredged, leaving a small balance to the credit of the work.

The dredged channel, in a narrow stream with soft bed and banks, can not maintain its depth or width.

The total amount expended to July 1, 1892, was $19,866.83, and for the fiscal year $10,405.96.

July 1, 1892, balance unexpended	$133.17
Amount appropriated by act approved July 13, 1892	11,690.00
	11,823.17
June 30, 1893, amount expended during fiscal year	10,405.96
July 1, 1893, balance unexpended	1,417.21
July 1, 1893, outstanding liabilities	10.25
July 1, 1893, balance available	1,406.96

(See Appendix M M 25.)

26. Turning basin in Rouge River, Michigan.—The act of July 13, 1892, appropriated $5,000 for purchase of site and beginning construction of a turning basin in the Rouge River. No action has yet been taken, as it has not yet been found practicable to acquire the area estimated for within the appropriation. A winding basin is needed in so narrow a stream as the Rouge, at a distance from its mouth, and the matter will be further investigated.

Amount appropriated by act approved July 13, 1892	$5,000.00
July 1, 1893, balance unexpended	5,000.00

(See Appendix M M 26.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. William Ludlow, Corps of Engineers, and reports thereon submitted through the division engineer, Col. O. M. Poe, Corps of Engineers:

1. Hammond Bay, Lake Huron, at the mouth of Ocqueoc River, Michigan.—Maj. Ludlow submitted report of examination under date of November 10, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not at this time worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 76, Fifty-second Congress, second session. (See also Appendix M M 27.)

2. Sebewaing River, Saginaw Bay, Michigan.—Maj. Ludlow submitted report of examination under date of January 27, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the river is worthy of a moderate degree of improvement by the General Government. No survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 237, Fifty-second Congress, second session. (See also Appendix M M 28.)

3. Pine River at St. Clair City, Mich.—Maj. Ludlow submitted report of examination under date of January 27, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the General Government to a limited extent. No survey is necessary for preparation of project and estimate of cost of improvement. The report was transmitted to Congress and printed as House Ex. Doc. No. 235, Fifty-second Congress, second session. (See also Appendix M M 29.)

4. Belle River, Marine City, Mich., from its mouth to Broadway Street Bridge.—Maj. Ludlow submitted report of preliminary examination under date of January 27, 1893. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy

of improvement by the General Government to a limited extent. The cost of a survey for preparation of project and estimate of cost of improvement is estimated at $600. The report was transmitted to Congress and printed as House Ex. Doc. No. 234, Fifty-second Congress, second session. (See also Appendix M M 30.)

IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

These works were in the charge of Col. O. M. Poe, Corps of Engineers, having under his immediate orders Lieut. Charles S. Riché, Corps of Engineers, the entire year, and Lieut. W. L. Sibert, Corps of Engineers, since August 28, 1892.

1. Ship channel connecting the waters of the Great Lakes, between Chicago, Duluth, and Buffalo.—Before improvements were commenced under the project for this work the available depth for navigation in the connecting waters of the Great Lakes was about 16 feet.

The present project, submitted to Congress in pursuance of provisions of the act of September 19, 1890, and adopted by act of July 13, 1892, contemplates the excavation of a ship channel having a navigable depth of 20 feet in the shallows of the connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo, at an estimated cost of $3,340,000.

The work is divided into eight sections, according to locality, and the following channels are to be excavated:

Section 1. A channel 21 feet deep and 300 feet wide at Round Island Shoals, St. Marys River.

Section 2. A channel 21 feet deep and 300 feet wide in Little Mud Lake, St. Marys River, between the lower end of Sugar Island and the lower end of the "Dark Hole."

Section 3. A channel 21 feet deep and 300 feet wide through a reef in St. Marys River, abreast of Sailors Encampment Island.

Section 4. A channel 21 feet deep and 300 feet wide through a shoal in Mud Lake, St. Marys River, 1½ miles below Sailors Encampment Island.

Section 5. A channel 21 feet deep and 2,400 feet wide at the foot of Lake Huron.

Section 6. A channel 20 feet deep from deep water in St. Clair River through St. Clair Flats Canal to deep water in Lake St. Clair, with a width above St. Clair Flats Canal not greater than 650 feet; thence gradually narrowing to the canal; thence for the full width of the canal for its entire length; thence gradually widening to a width of 800 feet at deep water in Lake St. Clair.

Section 7. A channel 20 feet deep and 800 feet wide through Grossepoint Flats, Lake St. Clair, Michigan.

Section 8. A channel 21 feet deep and 800 feet wide through the bar at the mouth of Detroit River.

To obtain a navigable depth of 20 feet, a depth of 21 feet is required where the excavation is through solid rock or through shoals infested with bowlders; a depth of 20 feet where the cut is through soft material.

Contracts for the excavations specified above are in force, and if no failure occurs in the appropriations the contract time for the completion of the specified channels is November 30, 1895.

Work was begun under contract at the eight localities named during May and June, 1893. The excavation has not advanced far enough to give any increased depth or width available for navigation.

To pay the various employés and contractors $200,000 will be required for the fiscal year ending June 30, 1895.

Amount appropriated by act approved July 13, 1892		$375,000.00
Amount appropriated by sundry civil act approved March 3, 1893		875,000.00
		1,250,000.00
June 30, 1893, amount expended during fiscal year		23,236.40
July 1, 1893, balance unexpended		1,226,763.60
July 1, 1893, outstanding liabilities	$3,035.54	
July 1, 1893, amount covered by uncompleted contracts	1,292,964.03	
		1,295,999.57
Amount (estimated) required for completion of existing project		2,090,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N N 1.)

2. Operating and care of St. Marys Falls Canal, Michigan.—During the fiscal year the canal was open to navigation 220 days. It was closed for the winter December 6, 1892, and opened May 1, 1893; 12,160 vessels, etc., aggregating 10,226,971 registered tons, and carrying 10,846,404 tons of freight and 23,919 passengers, passed through the canal in 5,611 lockages.

The staple articles transported were 2,771,667 tons of coal, 73,606 tons of copper, 5,627,778 barrels of flour, 40,959,960 bushels of wheat, 2,446,159 bushels of grain other than wheat, 4,668,807 tons iron ore, 620,531,000 feet B. M. of lumber, 47,176 tons building stone, and 371,350 tons of miscellaneous or unclassified freight.

The amount expended during the fiscal year ending June 30, 1893, was $41,828.07.

(See Appendix N N 2.)

3. St. Marys River at the Falls, Michigan.—The project for obtaining a navigable channel of 16 feet depth betweeen lakes Superior and Huron had been barely completed when the demands of commerce so enormously increased that the work of obtaining a depth of 20 feet throughout was undertaken with the full sanction of both legislative and executive authority.

A necessary part of the project is the construction of a new lock upon the site of the old State locks, to have a length of 800 feet between gates, a width of 100 feet throughout, a depth of 21 feet on the miter sills, and a single lift approximating 18 feet. The canal is to be deepened to correspond. The estimated cost of this enlargement of the canal system is $4,738,865, for the details of which see pp. 2220 *et seq.* of the Annual Report of the Chief of Engineers for 1887.

The cofferdam surrrounding the lock pit is in excellent condition. The pier in front of Fort Brady is completed. The filling behind this pier is completed so far as is necessary at present. The work on the masonry of the lock is progressing at about the rate required in the contract. The anchorages are nearly all in place and about half the snubbing hooks are in position. The valves and valve frames have been delivered. Contracts have been entered into for constructing the lock floor, culverts, breast walls, and miter sills, and for furnishing and placing in position the turbine-power plant. Designs and drawings for the gates have been completed and the specifications prepared and approved. Designs and drawings for the pumping plant have been

made and the specifications drawn. The designs and drawings for the operating machinery are well advanced.

The rate of progress on the work of deepening the canal prism is not as great as that called for in the specifications.

A contract has been entered into for widening the channel at the "Elbow," Lake George, St. Marys River.

Three hundred thousand dollars will be necessary for expenditures during the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended		$1,931,923.25
Amount appropriated by sundry civil act approved March 3, 1893		1,230,000.00
		3,161,923.25
June 30, 1893, amount expended during fiscal year		624,464.42
July 1, 1893, balance unexpended		2,537,458.83
July 1, 1893, outstanding liabilities	$102,761.88	
July 1, 1893, amount covered by uncompleted contracts	1,193,679.06	
		1,296,440.94
July 1, 1893, balance available		1,241,017.89
Amount (estimated) required for completion of existing project		783,865.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		300,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix N N 3.)

4. Hay Lake Channel, St. Marys River, Michigan.—Before improvements were commenced the channel through Hay Lake was restricted in depth at Sugar Island Rapids and at Middle Neebish. At these two places a maximum draft of but 8 or 9 feet could be carried if a very irregular course was taken, and practically vessels drawing more than 6 feet of water would not attempt the passage. In addition to the places above mentioned there were some shoals in Hay Lake requiring removal to make the channel available for vessels navigating St. Marys River.

The original estimates for this improvement were based upon a project for a channel 300 feet wide and 17 feet deep, leaving the present navigable channel of St. Marys River at Sugar Island Rapids (about 2½ miles below the canal), through these into Hay Lake, and then by way of Middle Neebish, rejoining the present navigable channel at the foot of Sugar Island, thus saving a distance of 11 miles and obtaining a route which can be so marked by lights as to be navigable at night, a condition impracticable with the present channel, except by the use of many lights.

The estimated cost of this project was $2,127,292. The project was subsequently modified to increase the navigable depth to 20 feet, the estimated cost being $2,659,115, subject to change, however, in case unexpected difficulties are developed during the progress of the work.

Prior to the beginning of work under the contracts now in force, 611,907.17 cubic yards, bank measure, had been excavated from the channel.

Under the six contracts for excavation now in force, a total of 2,650,461 cubic yards, bank measure, has been removed, of which 1,526,982 cubic yards was removed during the fiscal year. The total so far removed is in excess of that required by the specifications at the end of the fiscal year ending June 30, 1893, by 40,461 cubic yards.

To pay the various Government employés and contractors, $150,000 will be required for the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended		$565,325.56
Amount appropriated by sundry civil act approved August 5, 1892		115,000.00
Amount appropriated by sundry civil act approved March 3, 1893		225,000.00
		905,325.56
June 30, 1893, amount expended during fiscal year		345,357.34
July 1, 1893, balance unexpended		559,968.22
July 1, 1893, outstanding liabilities	$44,008.07	
July 1, 1893, amount covered by uncompleted contracts	236,010.33	
		280,018.40
July 1, 1893, balance available		279,949.82
Amount estimated required for completion of existing project		644,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1886 and 1887 and of sundry civil act of March 3, 1893.		

(See Appendix N N 4.)

5. St. Clair Flats Canal, Michigan.—The present project for the improvement of the canal contemplates driving a double row of sheet piling to a depth of 26 feet along the channel face of each dike, dredging the area between the dikes to a depth of 20 feet, continuing the channel above and below the canal to the same depth in river and lake and rebuilding the decayed portions of the timber superstructure. It was considered sufficient to obtain a depth of 18 feet and to postpone obtaining a depth of 20 feet until the general project for a continuous depth of 20 feet along the entire water route shall have reached a more advanced stage. The estimated cost of obtaining these two depths is as follows:

For 18 feet	$365,000.00
For 20 feet	513,559.40

On June 30, 1892, the pile revetment along the channel face of each dike was completed and a channel 18 feet in clear depth extended from the 18-foot curve in St. Clair River, about 900 feet above the canal, for the full width of the canal (about 300 feet), and throughout its entire length; thence gradually widening to 380 feet in a distance of 300 feet below the canal, thence with a width of 380 feet for a further distance of 2,400 feet.

Dredging was continued during the fiscal year until July 15, 1892.

On June 30, 1893, a channel 18 feet in depth extended from the 18-foot curve in St. Clair River, about 900 feet above the canal, for the full width of the canal (about 300 feet), and throughout the entire length; thence gradually widening to 380 feet at a distance of 300 feet below the canal; thence with a width of 380 feet a further distance of 3,300 feet.

That portion of the general project calling for a depth of 20 feet in the canal and the approaches has been provided for in the river and harbor act of July 13, 1892, for "ship channel connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo."

The pile revetment along the channel face of the dikes having been completed, the rebuilding of the decayed portions of the timber superstructure constitutes the work yet to be done.

This timber has been in place some twenty-five years and is in very bad condition. The amount necessary to rebuild the timber superstructure is estimated to be not less than $120,000; and this entire amount can be profitably expended during the fiscal year ending June 30, 1895. The necessity for this work is very urgent.

July 1, 1892, balance unexpended	$15,049.10
June 30, 1893, amount expended during fiscal year	10,461.96
July 1, 1893, balance unexpended	4,587.14

Amount (estimated) required for completion of existing project	196,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	120,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix N N 5.)

6. Operating and care of St. Clair Flats Canal, Michigan—The canal is in the immediate charge of a custodian, who reports any violations of canal regulations, and also acts as inspector whenever work is in progress.

During the spring of 1893 the damage done to the east dike by the Steamer *Phillip Minch* was repaired, and work of repairing the damage done to dikes by storms was begun. The cost of this work was $147.95.

During the fiscal year ending June 30, 1893, the ordinary current expenses of operating and care of the canal, such as salary of custodian, trimming willows, etc., exclusive of the amount named above, was $2,527.98.

(See Appendix N N 6.)

7. Grossepoint Channel, Michigan—Between the lower end of St. Clair Flats and the deep water of Detroit River, the only known obstruction to navigation is the large shoal off Grossepoint, known as Grossepoint Flats. At ordinary stages of water vessels drawing 16 feet can cross this obstruction, but when the water is as low as it has been during the last few years vessels drawing more than 15 feet can pass only with great care and difficulty.

The river and harbor act of August 11, 1888, appropriated $75,000 for "improving St. Clair Flats Ship Canal, * * * all or any portion of which may, in the discretion of the engineer, be expended in dredging Grosse Pointe Channel." The sum of $5,000 was consequently reserved from this appropriation for the removal of any small and well defined obstruction that might be found at Grossepoint, as well as for making such surveys as might be necessary before making a definite project. A small shoal was removed in July, 1889, but no more such obstructions have since been found.

Grossepoint Channel forms part of the "ship channel connecting the waters of the Great Lakes between Chicago, Duluth and Buffalo," which is provided for in the river and harbor act of July 13, 1892, and all information and estimates concerning the work at this point will be found in the report for last-named work.

July 1, 1892, balance unexpended	$3,844.05
July 1, 1893, balance unexpended	3,844.05

(See Appendix N N 7.)

8. Detroit River, Michigan.—Originally the channel at Lime Kiln Crossing, Detroit River, could not be depended upon for more than 13 feet of water, the ordinary depth being much affected by the direction of the wind. As originally projected in 1874, the improvement at this point was to consist of a curved channel 300 feet wide, with a uniform depth of 20 feet; and the original estimate was based upon this project.

In 1883 it was wisely determined to so modify the project as to secure a straight channel, the least width of which should be 300 feet,

with a somewhat greater width at each end, utilizing the work already done.

In 1886 this was further modified to the end that the width of the channel should be increased to 400 feet by removing an additional 100 feet from the western (American) side; and in 1888 a further additional width of 40 feet on the western side was authorized, as the lowest bid under the final appropriation was so low that the money available was sufficient to pay for the increased excavation.

The 440-foot channel was completed during the fiscal year ending June 30, 1891, at a cost of but little more than half the estimate for the 400-foot channel.

The present project for improving Detroit River contemplates the removal of such shoals between Detroit, Mich., and Lake Erie as obstruct navigation.

The only work done during the fiscal year ending June 30, 1893, has been the ascertaining of the location and extent of the obstructions between Ballards Reef and the head of Lime Kiln Crossing.

The obstructions found, consisting of bed rock and bowlders, are more serious and extended than was supposed; and, since nearly 25,000,000 tons of freight pass through this river each year, these obstructions should all be removed, cost what it may.

The estimate for obtaining a channel 20 feet deep and 800 feet wide from the head of Ballards Reef to the head of Lime Kiln Crossing is $180,000, of which $28,744.95 is available, from appropriation made under previous estimate, leaving $151,255.05 to be appropriated, all of which will be required during the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended		$923.89
Amount appropriated by act approved July 13, 1892		30,000.00
		30,923.89
June 30, 1893, amount expended during fiscal year		1,760.69
July 1, 1893, balance unexpended		29,163.20
July 1, 1893, outstanding liabilities		418.25
July 1, 1893, balance available		28,744.95
Amount (estimated) required for completion of existing project		151,255.05
Amount that can be profitably expended in fiscal year ending June 30, 1895		151,255.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix N N 8.)

INVESTIGATION OF RAFT-TOWING ON THE GREAT LAKES AND THEIR CONNECTING WATERS, IN COMPLIANCE WITH JOINT RESOLUTION APPROVED FEBRUARY 3, 1893.

Under the provisions of joint resolution approved February 3, 1893, a Board, consisting of Col. O. M. Poe, Maj. Charles E. L. B. Davis, and Maj. Clinton B. Sears, Corps of Engineers, was by authority of the Secretary of War constituted by Special Orders No. 7, Headquarters, Corps of Engineers, February 23, 1893, "to investigate the subject of raft-towing on the great lakes and their connecting waters, and to report to Congress as to what restrictions, if any, should be placed upon the size and manner of constructing and towing rafts upon said Great Lakes and their connecting waters." The report of the Board will be submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE ERIE WEST OF ERIE, PENNSYLVANIA.

This district was in the charge of Lieut. Col. Jared A. Smith, Corps of Engineers, with Lieut. William V. Judson, Corps of Engineers, under his immediate orders to February 10, 1893.

1. Monroe Harbor, Michigan.—This harbor is in the Raisin River, the piers being at the mouth of the dredged canal which now forms part of the river, and the wharves being about two and a half miles above.

Improvements were commenced in 1835 upon a plan devised in 1834 to cut a canal through the low marshy point which separated the river from the lake. The canal is 4,000 long, 100 feet wide, and was dredged to a depth of 10 feet. The sides of the canal are protected by a sheet piling supported by ordinary piles and waling pieces. The mouth of the river at entrance to canal is protected by piers extending into the lake.

A project for repairs of piers and canal revetment was adopted in 1886, the cost then being estimated at $20,000. In 1891 the estimate was amended to $26,000.

The total amount expended upon the improvement from 1836 to June 30, 1892, was $225,515.27.

The channel in general has a depth of not less than 9 feet to the wharves at Monroe. The revetment and piers are badly decayed, and storms in the spring of 1893 tore away considerable of the superstructure of the north pier.

The appropriation of $10,000 made by act of July 13, 1892, will be expended in making necessary repairs to north pier.

A survey of the harbor was made in October, 1892, and the channel was found in such condition that no dredging is required at present.

The work of repair was commenced early in June by hired labor and purchase of materials in open market, that being the most advantageous and economical method for the United States.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	307.28
July 1, 1893, balance unexpended	9,692.72
July 1, 1893, outstanding liabilities	2,262.55
July 1, 1893, balance available	7,430.17

Amount (estimated) required for completion of existing project (repairs)	16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	16,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 1.)

2. Toledo Harbor, Ohio.—The original project for improving this harbor was adopted in 1866, pursuant to the act of June 23, 1866, appropriating $20,000 for the improvement. The project provided for improving the old channel through Maumee Bay by dredging to a depth of 12 feet and width of 200 feet. This was amended from time to time, until the old channel had a least depth of 15.5 feet.

In 1887 a project was adopted, in compliance with previous acts of Congress, for a straight channel through Maumee Bay, 200 feet wide at the bottom and 17 feet deep, referred to the mean level of the lake. The line was so located as to utilize the old channel as far as possible.

The estimated cost of the last project was $1,875,000. The total amount appropriated and expended for old channel to June 30, 1892, was $724,332.61.

As a result the channel has been dredged as originally planned, save a single cut 25 feet wide and 2,400 feet long in outer section, and a cut 30 feet wide and 1,300 feet long in turn-out division. The channel, however, filled so that the average depth was but 15.6 feet.

The officer in charge of the improvement recommended that but one-half of the last appropriation of $200,000 be expended in dredging the straight channel because that amount would complete the original dredging of straight channel and would redredge a part which had filled; it was also recommended that a dredge, scows, and tug be purchased and that the balance of the appropriation be used to operate the dredge, to maintain depths in the straight channel, and to extend the removal of shoal in old channel, and extending improvement up the Maumee River.

These recommendations were approved. Surveys of straight channel were made in the autumn of 1892 and spring of 1893.

After advertising three times for proposals, a contract was awarded in December, 1892, for dredging in straight channel. Dredging was commenced early in the spring, and will be continued until the contract is completed.

The channel in turn-out section has been completed and good progress has been made elsewhere. The straight channel is regularly navigated by day, but is not well lighted, so that navigation by night is difficult. It has been found necessary to widen the outer section to 300 feet. It is proposed to expend the next appropriation in widening the channel in outer section, in maintaining depth throughout, and in strengthening pile protection in turn-out.

Old channel.

July 1, 1892, balance unexpended	$476.37
June 30, 1893, amount expended during fiscal year	476.37

Straight channel.

July 1, 1892, balance unexpended		15,458.50
Amount appropriated by act approved July 13, 1892		200,000.00
		215,458.50
June 30, 1893, amount expended during fiscal year		20,485.95
July 1, 1893, balance unexpended		194,972.55
July 1, 1893, outstanding liabilities	$6,605.89	
July 1, 1893, amount covered by uncompleted contracts	89,750.34	
		96,356.23
July 1, 1893, balance available		98,616.32

Amount (estimated) required for completion of existing project	1,200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	300,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O O 2.)

3. Port Clinton Harbor, Ohio.—In 1870 the channel at the entrance to this harbor was narrow and intricate, with a depth of only 5 feet.

The present project, adopted in 1875, provides for a pile revetment from the north shore of the Portage River, opposite the town, 967 feet into the lake, and two pile piers 200 feet apart, of an aggregate length of 4,100 feet, extending to the depth of 10 feet in the lake, with a view of maintaining a depth of 9 feet between them.

The total expenditures to June 30, 1892, amounted to $66,000.

As a result the east and west piers have been extended to within 420 feet and 480 feet of completion, respectively.

The act of July 13, 1892, appropriated $10,000 for improving this harbor, with a condition that $1,200 of the amount be paid to Charles Roose, of Oak Harbor, Ohio, in full satisfaction for the necessary portion of the sand beach adjoining the inner end of the west revetment. The land has been surveyed and deeds made out in complete form, but the payment has not been made because of delay in examination of title by the United States attorney.

A contract has been made for widening the channel of 10 feet depth by dredging. Work is to be completed on or before November 30, 1893.

The piers are now very rotten, and unless soon repaired will go to complete ruin. The officer in charge recommends that the project be not completed, but that the amount estimated therefor be expended in much-needed repairs.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	175.54
July 1, 1893, balance unexpended	9,824.46
July 1, 1893, amount covered by uncompleted contracts	8,000.00
July 1, 1893, balance available	1,824.46
Amount (estimated) required for completion of existing project	27,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	27,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O O 3.)

4. Sandusky Harbor, Ohio.—Various improvements to this harbor were made from 1826 to 1879, at a total cost of $222,980. The channel over the bar had but 10 feet depth and the greatest depth inside was about 12 feet in 1880.

In 1880 a definite project was adopted for a channel 200 feet wide and 15 feet deep through the outer bar and by an indirect route to the city wharves along the front of which the channel was to be 100 feet wide and 15 feet deep. This work was nearly completed in 1888 when a project was adopted for a straight channel 200 feet wide and 17 feet deep from the east end of the wharf channel to the north end of Cedar Point. The estimated cost of this project was $96,712.

The amount expended on this work to June 30, 1892, was $69,185.29. As a result the straight channel has been so far dredged that the removal of 250,000 cubic yards will complete it entirely. A contract has been let for completing the work and is to be finished on or before November 30, 1893.

The completion of the work will still leave the channel along the wharves but 100 feet wide and 15 feet deep. Reports were received that this channel has been somewhat filled.

The expenses of last fiscal year have been for a necessary survey of the straight channel and channel over the bar; the latter now has a least depth of 16 feet over a width in narrowest place of 90 feet.

July 1, 1892, balance unexpended	$2,088.54
Amount appropriated by act approved July 13, 1892	41,712.00
	43,800.54
June 30, 1893, amount expended during fiscal year	523.24
July 1, 1893, balance unexpended	43,277.30
July 1, 1893, amount covered by uncompleted contracts	33,750.00
July 1, 1893, balance available	9,527.30
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix O O 4.)

5. Sandusky River, Ohio.—In 1880 a project was adopted for opening a channel 100 feet wide and 9 feet deep through the bars between the city of Fremont and the channel in Sandusky Bay. The expense was estimated to be $44,000.

Previous to June 30, 1892, the sum of $23,000 had been appropriated and expended for the work.

As ten years has been occupied in expending a little more than one-half the amount estimated to complete the improvement, and this in a silt-bearing stream, it is not probable that the result in present condition is commensurate with the cost.

The act of July 13, 1892, appropriated $5,000 for the improvement. An examination of the channel and a survey of bars near the mouth of river was made in September, 1892. Dredging was found to be necessary through a long bar at the mouth of the river. A contract for the dredging, to be completed by November 30, 1893, has been made in connection with similar work at Port Clinton, Huron, and Black River.

The expenditures of the year have been for the survey, advertising, and other contingent expenses.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	152.79
July 1, 1893, balance unexpended	4,847.21
July 1, 1893, amount covered by uncompleted contracts	4,500.00
July 1, 1893, balance available	347.21
Amount (estimated) required for completion of existing project	16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	16,000.00

(See Appendix O O 5.)

6. Huron Harbor, Ohio.—In 1826 the mouth of the river was closed by a sand bar. Improvements consisting of parallel piers to confine and protect the channel were then undertaken.

The project has been modified and extended from time to time as the demands of commerce required. The latest project, approved in 1890, consists in extending the piers to the contour of 16 feet in the lake with the view of obtaining that depth at the entrance and between the piers.

The total amount expended from 1826 to June 30, 1892, was $139,273.71. As a result the channel had been recovered from a sand bar sometimes dry and given a depth ordinarily 16 feet or more between piers about 140 feet apart; the depth outside of piers is, however, somewhat less except where recently dredged.

The amount expended in last fiscal year is $227.97.

A survey of the harbor was made in October, 1892.

A contract has been let for extending the east pier 80 feet and west pier 40 feet. Work under contract was commenced June 6, 1893, and is progressing satisfactorily. It will be completed in August.

A contract has also been let for the small amount of dredging which will be required to clear the channel through the bar.

Dredging and repairs of old work are found necessary from time to time, but definite estimates can not be submitted in advance.

The estimate for completion of project covers the original cost of extending the piers to the depth of 16 feet in the lake.

The expenditures of last fiscal year have been for a survey, advertising, and contingent office expenses.

Amount appropriated by act approved July 13, 1892		$15,000.00
June 30, 1893, amount expended during fiscal year		227.97
July 1, 1893, balance unexpended		14,772.03
July 1, 1893, outstanding liabilities	$125.00	
July 1, 1893, amount covered by uncompleted contracts	10,410.61	
		10,535.61
July 1, 1893, balance available		4,236.42

Amount (estimated) required for completion of existing project	114,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 6.)

7. *Vermillion Harbor, Ohio.*—In 1836 there was less than 2 feet of water over the bar at the mouth of the river and a project was adopted to extend parallel piers, 125 feet apart, over the bar into the lake. This was amended from time to time until the piers were extended to a depth of 12 feet in the lake in the spring of 1874. The east pier was then 1,075 feet and the west pier 1,125 feet in length. In the same year a project was adopted to remove rock and other material between the piers and into the lake to afford a depth of 14 feet over a width of 100 feet. This was completed in 1879.

Since that time the channel has varied, but is rarely less than 12 feet. The piers have been repaired from time to time.

The amount expended to June 30, 1892, was $124,701.28; amount expended in last fiscal year, $4,000.

The expenditures of the last fiscal year have been for repairing the superstructure of piers. Three hundred and seventeen linear feet of superstructure on east pier at outer end has been rebuilt entirely, and other parts of both piers have been repaired.

Five hundred and two linear feet of the outer end of east pier is now in good condition. Seventy-two linear feet of inner end is in fair condition; the remainder is in very bad condition and should be renewed. The deck of west pier is in fair condition, but the timber above water is rotten and the superstructure should be rebuilt.

July 1, 1892, balance unexpended	$2,000.00
Amount appropriated by act approved July 13, 1892	2,000.00
	4,000.00
June 30, 1893, amount expended during fiscal year	4,000.00

Amount (estimated) required for completion of existing project	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 7.)

8. Black River Harbor, Ohio.—Improvements upon this harbor were commenced in 1828 by extending parallel piers or jetties across the bar to protect and confine the channel. Various amendments and additions to the plan have been made from time to time. In 1891 the extension of piers to 17 feet depth in the lake was recommended by the officer in charge of this improvement.

The entire amount expended in improving this harbor to June 30, 1892, was $232,204.77. As a result the piers have been extended to a depth of about 16 feet in the lake, and the channel ordinarily had a clear depth of 16 feet in the middle. This is, however, subject to fluctuations, and it is usual for a bar to form at the entrance during the fall, winter, and spring, so that a small amount of dredging is annually required.

The expenditures of the last year have been $1,784.11.

In September, 1892, a survey of the channel and approaches was made, showing a good channel of 16 feet depth.

In November, 1892, a bar had formed across the entrance so that the depth at that place was but 14 feet. A dredge was therefore employed and the channel through the bar was dredged to a depth of 17 feet and width of 140 feet.

The old east pier had been so much injured that it became necessary to remove and rebuild a section of 120 feet length. Repairs were also required on west pier. A contract has been let for making these repairs and for extending the piers as far as the balance of funds will permit. The repairs and maintenance of channel by dredging will cost not less than $10,000, leaving but one-half on the last appropriation to be applied on the extension of piers. Work under the contract will be completed on or before November 30, 1893.

Amount appropriated by act approved July 13, 1892		$20,000.00
June 30, 1893, amount expended during fiscal year		1,784.11
July 1, 1893, balance unexpended		18,215.89
July 1, 1893, outstanding liabilities	$16.67	
July 1, 1893, amount covered by uncompleted contracts	17,000.00	
		17,016.67
July 1, 1893, balance available		1,199.22
Amount (estimated) required for extending piers to depth of 17 feet		46,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		46,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix O O 8.)

9. Cleveland Harbor, Ohio.—In 1825 the mouth of the Cuyahoga River was obstructed by a long sand bar and the depth of water was but about 3 feet.

A project of improvement was adopted to straighten the river at its mouth by a cut across the long point and by protecting and confining the channel by piers. The plan was modified and extended from time to time until the piers had reached a depth of 16 feet in the lake. This project was completed in 1869.

In 1875, in accordance with an act of Congress, a project was adopted for a harbor of refuge, as the harbor in the river afforded no anchorage. The project as amended includes two breakwaters, one east and one west of the channel entrance. The west breakwater was completed in 1883; its length, including shore arm and spur, is 7,278 feet. Previous to June 30, 1892, the east breakwater had been extended a distance of

2,043 linear feet, besides a spur of 118 feet length near the entrance. The harbor now affords a good refuge and anchorage.

The total expenditure to June 30, 1892, which includes maintenance of channel and piers, was $1,167,118.25.

A survey of the harbor was made in August, 1892, which showed that a large amount of dredging was required to clear the channel and improve the anchorage. A part of the last appropriation is therefore to be expended for this purpose.

In October, 1892, a contract was made with the lowest bidder for 450 feet extension of the east breakwater. At the end of the fiscal year 150 linear feet had been put in position and raised to the mean lake level. The remainder will be completed in the season of 1893.

In November, 1892, it became necessary to dredge in channel where a bar had formed. This was done by hiring a dredge by the day, as the time did not permit of doing the work by contract.

In March, 1893, a contract was made for dredging in Cleveland Harbor in connection with similar work at Fairport and Ashtabula harbors. Work under this contract was commenced May 1, and is still in progress. Dredging will be continued during the summer months.

July 1, 1892, balance unexpended		$1,631.75
Amount appropriated by act approved July 13, 1892		100,000.00
		101,631.75
June 30, 1893, amount expended during fiscal year		13,490.26
July 1, 1893, balance unexpended		88,141.49
July 1, 1893, outstanding liabilities	$17,326.97	
July 1, 1893, amount covered by uncompleted contracts	69,907.61	
		87,234.58
July 1, 1893, balance available		906.91
Amount (estimated) required for completion of existing project		494,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix O O 9.)

10. Fairport Harbor, Ohio.—The harbor of Fairport is near the mouth of the Grand River, Ohio, which is navigable for some distance from the lake.

In 1825 the sand bar across the mouth was so hard and dry in the summer that teams could be driven across. In that year a plan was adopted for improving the harbor by the method of parallel piers to confine and protect the channel. The plans have been modified and extended from time to time until 1890, when the latest project was adopted providing for extending the parallel piers to a depth of 18 feet in the lake, with the dredging needed to secure a channel of same depth.

At the time the latest project was adopted the channel depth between piers was 16 feet, and over the bar 15½ feet.

The total expenditures for construction, maintenance, and repairs to June 30, 1892, were $319,503.08.

A hydrographic survey of the channel and approaches was made in August, 1892, and the estimate for cost of extending piers to a depth of 18 feet was amended to conform to results of survey.

In November, 1892, the bar had formed at mouth of river so that it became necessary to dredge the channel.

In March, 1893, a contract was let, after advertising in the usual manner, for such dredging as might be required in the spring of 1893. Dredging, under the contract, was commenced June 6, and continued through the month. It will require about one week more for completion. A contract for extension of east and west piers, each 120 feet, was let in December, 1892, after inviting proposals by public advertisement. Framing of timbers was commenced early in June, but no cribs were sunk previous to June 30. This work will be completed in the season of 1893.

The estimate for completion of project is for cost of piers only. A considerable amount of dredging is required annually for keeping the channel clear over the bar. The superstructure of part of the old work is in bad condition, and should be rebuilt.

It is proposed to expend the sum which may be appropriated for such repairs and dredging as may be indispensable, and for extension of piers, as far as possible, toward the depth of 18 feet.

July 1, 1892, balance unexpended		$1,370.45
Amount appropriated by act approved July 13, 1892		35,000.00
		36,370.45
June 30, 1893, amount expended during fiscal year		1,505.69
July 1, 1893, balance unexpended		34,864.76
July 1, 1893, outstanding liabilities	$2,440.85	
July 1, 1893, amount covered by uncompleted contracts	22,605.54	
		25,046.39
July 1, 1893, balance available		9,818.37
Amount (estimated) required for completion of existing project		190,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix O O 10.)

11. Ashtabula Harbor, Ohio.—In 1826 the natural conditions at the mouth of the Ashtabula River gave but 2 feet depth of water over the bar, and the rock bottom was but 9 feet below the lake surface.

Improvements were then commenced by confining the channel between piers of timber crib work filled with stone. The work was modified and extended from time to time, as the necessities of commerce developed, until the latest project, adopted in 1890 and amended in 1891, which contemplates widening the harbor entrance by moving part of the east pier 45 feet eastward, extending both piers to a depth of 22 feet in the lake, and deepening the channel to 20 feet.

The removal of east pier 45 feet will make the width between piers 213 feet, instead of 205 feet, as indicated in former reports.

The expenditures from 1826 to June 30, 1892, were $319,503.08. The result was a channel 165 feet between piers and a depth of 17 feet in the middle, subject to the formation of bars at entrance by freshets and storms.

In August, 1892, a survey was made covering the channel between piers and the bar outside. The soundings were made to the sand, and were then extended to the underlying rock. The soundings to the rock were supplemented in January, 1893, by working through holes cut in the ice.

In October, 1892, a contract was let for removal of 242 linear feet of old pier and replacing it on a line 45 feet east of former location; also to extend east pier 240 feet and west pier 200 or more feet. At the

end of the fiscal year the removal and rebuilding of old pier was a little more than two-thirds accomplished, and the framing of cribs for extending piers was well advanced.

In March, 1893, a contract was concluded for dredging the channel through the bar in anticipation of the result of spring freshets and storms. The amount of dredging was less than usual and was completed early in June.

The work under contract will be completed in the season of 1893.

July 1, 1892, balance unexpended		$8,886.75
Amount appropriated by act approved July 13, 1892		70,000.00
		78,886.75
June 30, 1893, amount expended during fiscal year		8,833.73
July 1, 1893, balance unexpended		70,053.02
July 1, 1893, outstanding liabilities	$7,873.02	
July 1, 1893, amount covered by uncompleted contracts	47,468.27	
		55,341.29
July 1, 1893, balance available		14,711.73

Amount (estimated) required for completion of existing project	255,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	255,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 11.)

12. Conneaut Harbor, Ohio.—The act of Congress approved September 19, 1890, required an examination or survey of Conneaut Harbor. Reports were submitted to Congress and printed in House Ex. Doc. No. 42, Fifty-second Congress, first session (reprinted as Appendix M M 14, Annual Report, Chief of Engineers, 1892). The river and harbor act approved July 13, 1892, appropriated $40,000 for relocating the channel and constructing piers in accordance with Scheme B of Engineer's report.

Examinations of the bottom along line of proposed new location, in August, 1892, showed that a large amount of rock would be encountered, so that the expense would be increased. No immediate benefit could result if the appropriation were to be expended on the new location, so that commencement of work was deferred. By act approved February 24, 1893, Congress amended the appropriation act so that the improvement should be in accordance with Scheme A, "to widen and deepen the old channel."

Proposals were invited by public advertisement, and a contract had been closed with the lowest bidder for construction of part of west pier, commencing at outer end of old pier and extending into the lake 320 feet or more. The work is to be completed on or before November 30, 1893.

The expenditures of the last year have been for survey, examinations of bottom by borings and dredging, and for advertising and other contingent items.

The project adopted is for parallel piers to a depth of 17 feet in the lake and for the necessary dredging to secure 17 feet depth of water.

Improvements were made to this harbor between 1829 and 1875 by constructing parallel piers about 100 feet apart and dredging. The channel previously had a depth of only 2 feet. The result of the improvements was a depth of 8 to 9 feet ordinarily, with a maximum depth of 11 feet in a few instances.

The works were allowed to go to decay and ruin, so that when the

present project was adopted the depth over bar at mouth of river was less than 3 feet.

The expenditures previous to June 30, 1892, were $106,629.39; expenditures in last fiscal year, $692.91.

The harbor has been considerably improved by the Pittsburgh, Shenango and Lake Erie Railroad Company. The company has dredged the channel and repaired the old piers under authority from the Secretary of War, upon conditions that the United States shall not reimburse the expense. As a result of the work done by the railroad company, considerable iron and coal have been received and shipped at the harbor.

Amount appropriated by act approved July 13, 1892	$40,000.00
June 30, 1893, amount expended during fiscal year	692.91
July 1, 1893, balance unexpended	39,307.09
July 1, 1893, amount covered by uncompleted contracts	35,506.40
July 1, 1893, balance available	3,800.69
Amount (estimated) required for completion of existing project	460,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix O O 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—Two wrecks in Port Clinton Harbor, Ohio, one of the sail boat *Rescue*, the other of the tug *Wilcox*, an allotment of $100 for the removal of which was made from the permanent appropriation of June 14, 1880, by the Secretary of War May 17, 1892, were removed during September, 1892, at a total cost of $40, under informal agreement with Messrs. St. John & Freer, of Port Clinton, Ohio, the lowest bidders. (See Appendix O O 13.)

IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF RIVERS AND HARBORS IN WESTERN NEW YORK.

This district was in the charge of Maj. E. H. Ruffner, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Erie Harbor, Pennsylvania.—The original survey of this harbor was made in 1819, at which time the channel was narrow and tortuous, with a depth of only 6 feet. In 1823 a plan for the improvement was adopted, and constitutes the present work at the entrance to the harbor, excepting some changes which have been required, either on account of the age of the structures already built or other causes. The piers have been extended from time to time, and are now in pretty good order and condition. The north pier needs considerable repairs.

The present project contemplated the extension of the piers to the 16-foot curve in the lake and the maintenance of a channel of navigable width 16 feet in depth from the harbor inside to the lake outside.

Operations have been prosecuted with more or less interruption and suspension (no work was done from 1838 to 1842, from 1846 to 1853, and from 1855 to 1864), and have resulted in much benefit to the harbor and its channel entrance. The work during the year consisted in the extension of the north pier for 300 feet, of which 5 cribs were sunk at the end of the year and the last since that date. The total amount expended up to June 30, 1892, was $798,892.33. The amount expended during the fiscal year ending June 30, 1893, was $4,609.47.

July 1, 1892, balance unexpended (including $20,000 reserved for Presque Isle)		$37,691.79
Amount appropriated by act approved July 13, 1892		40,000.00
		77,691.79
June 30, 1893, amount expended during fiscal year		4,609.47
July 1, 1893, balance unexpended		73,082.32
July 1, 1893, outstanding liabilities	$10,706.50	
July 1, 1893, amount covered by uncompleted contracts	14,219.41	
		24,925.91
July 1, 1893, balance available (including $20,000 reserved for Presque Isle)		48,156.41
Amount that can be profitably expended in fiscal year ending June 30, 1895. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		25,000.00

(See Appendix P P 1.)

2. Presque Isle Peninsula, Erie Harbor, Pennsylvania.—In a report upon the examination of Erie Harbor, made in 1885, it was recommended that the neck of the peninsula be protected by a breakwater, and the movement of sand around the eastern end of the peninsula, which threatens to close the harbor entrance, be arrested by the construction of jetties perpendicular to the shore of the peninsula, at an estimated cost of $173,044.50.

Work under this project was in progress until October, 1889, when it was abandoned, it having been found that the structures built would not stand against the violence of the storms. No further work is at present contemplated, but the sum of $20,000 has been reserved from the appropriation for the improvement of Erie Harbor, to be used in case of necessity in closing any breach which might occur.

The total amount expended up to June 30, 1890, was $60,000. Nothing was expended during the fiscal year ending June 30, 1893.

(See Appendix P P 2.)

3. Dunkirk Harbor, New York.—The improvement of this harbor was commenced in 1827, when the first appropriation therefor was made. The original project was much the same as that of the existing improvement, which comprises the formation of an artificial harbor in front of the city by means of a breakwater running nearly parallel with the shore, and a shore arm or pier to the westward, with an opening between the piers and the breakwater. By 1832 the sum of $28,489.84 had been expended on the original plan, and the breakwater was then 2,564 feet long and the pier 1,400 feet long.

Various improvements and repairs were made from time to time, and by 1838 there had been completed 2,125 feet of breakwater and 300 feet of detached breakwater. In 1848 the breakwater was demolished.

Between 1848 and 1870 some portions of the work were renewed and others repaired, but in 1870 a board of engineers took into consideration the question of the radical improvement of the harbor. The board recommended a plan which provided a breakwater 2,860 feet long, one part of which, 2,300 feet in length, was to be nearly parallel with the shore, the other part to be nearly parallel to the axis of the channel entrance, 560 feet long, and terminating at the position of the dumb beacon, and the formation of a channel 170 feet wide and 13 feet deep. Of the 2,300-foot section, 1,341 feet has been completed; none of the 560-foot section has been built.

Work during the year consisted in repairing parts of the breakwater and west pier. These structures are now in fairly good condition and should hold their own for some time. There is a contract for an extension of 250 feet to the breakwater that should be built this year.

The channel requires considerable rock excavation and dredging to make it 170 feet wide, as proposed, and of full depth.

The total amount expended up to June 30, 1892, was $500,017.98, not including outstanding liabilities. The amount expended during the fiscal year ending June 30, 1893, was $10,344.

July 1, 1892, balance unexpended		$14,061.40
Amount appropriated by act approved July 13, 1892		20,000.00
		34,061.40
June 30, 1893, amount expended during fiscal year		10,344.00
July 1, 1893, balance unexpended		23,717.40
July 1, 1893, outstanding liabilities	$1,820.66	
July 1, 1893, amount covered by uncompleted contracts	15,114.56	
		16,935.22
July 1, 1893, balance available		6,782.18
Amount (estimated) required for completion of existing project		128,116.41
Amount that can be profitably expended in fiscal year ending June 30, 1895		108,630.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix P P 3.)

4. Buffalo Harbor, New York.—The original project for the improvement of this harbor was adopted in 1826, and, as modified at various times, provided for the construction of piers on the north and south sides of Buffalo Creek, a masonry sea wall running south from the inshore end of the south pier, and a breakwater less than half a mile in front of the light-house, its long arm being nearly parallel with the shore.

The present project was adopted in 1874, and provided for the construction of a breakwater of crib work 7,600 feet long, running parallel with the shore, and a shore arm of piles and crib work, 4,100 feet long, running out toward the southern end of the main or detached breakwater, leaving an opening of 150 feet between them.

In 1887 this project was amended so that in the reconstruction of superstructure concrete was substituted for timber crib work.

During the past year the extension of the breakwater and the building of 1,600 feet of the shore arm, under three contracts of 800 feet each, were in progress. In all 9 cribs have been sunk, and 17 more are in various degrees of building. The total amount expended up to June 30, 1892, not including outstanding liabilities, was $2,452,767.67. The amount expended during the fiscal year ending June 30, 1893, was $17,032.62.

July 1, 1892, balance unexpended		$38,903.99
Amount appropriated by act approved July 13, 1892		300,000.00
		338,903.99
June 30, 1893, amount expended during fiscal year		17,032.62
July 1, 1893, balance unexpended		321,871.37
July 1, 1893, outstanding liabilities	$12,533.88	
July 1, 1893, amount covered by uncompleted contracts	272,360.79	
		284,894.67
July 1, 1893, balance available		36,976.70

Amount (estimated) required for completion of existing project	$146,223.17
Amount that can be profitably expended in fiscal year ending June 30, 1895	146,223.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 4.)

5. Tonawanda Harbor and Niagara River, New York.—The project for this work contemplates a channel 18 feet deep and 400 feet wide from the entrance to the Niagara River at Lake Erie to the north end of Tonawanda Harbor, New York. The work of the year has consisted in dredging the harbor of Tonawanda to the full depth of 16 feet throughout and in continuing the removal of the rock bottom that is above grade in the channel of the Horse Shoe Reef. Contracts exist for continuing the work at this point and in the channel near Strawberry Island. The amount expended up to June 30, 1892, not including outstanding liabilities, was $148,857.61. The amount expended during the fiscal year ending June 30, 1893, was $30,878.90.

July 1, 1892, balance unexpended		$29,142.39
Amount appropriated by act approved July 13, 1892		75,000.00
		104,142.39
June 30, 1893, amount expended during fiscal year		30,878.90
July 1, 1893, balance unexpended		73,263.49
July 1, 1893, outstanding liabilities	$6,814.47	
July 1, 1893, amount covered by uncompleted contracts	46,126.36	
		52,940.83
July 1, 1893, balance available		20,322.66

Amount (estimated) required for completion of existing project	1,008,090.16
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 5.)

6. Niagara River from Tonawanda to Port Day (Niagara Falls), New York.—Under provisions of act of September 19, 1890, a survey of this locality was made by Lieut. Col. Amos Stickney, Corps of Engineers; and his report thereon of December 31, 1891, with project for improvement, was submitted to Congress and printed as House Ex. Doc. No. 67, Fifty-second Congress, first session (reprinted as Appendix N N 9, Annual Report, Chief of Engineers, 1892). This project contemplated the formation of a channel 300 feet wide from Tonawanda down to Conners Island, 200 feet wide from Conners Island to Grass Island, and increasing from 200 to 400 feet wide from Grass Island to Port Day; and construction of an embankment, from rock excavated from the channel, extending from Conners Island to Port Day, so as to inclose the lower end of the channel; a channel of 8 feet depth was to be first provided, which could be enlarged as an increase of commerce might demand. The cost of the proposed channel 8 feet deep at mean lake level (6 feet at low lake level) was estimated at $257,829.

The river and harbor act approved July 13, 1892, appropriated $20,000 for the commencement of work upon the 8-foot channel.

During the season of 1892 the practicability of constant navigation of Niagara River by vessels of upward of 6 feet draft to the harbor back of Conners Island, which is within easy land communication with Port Day, was demonstrated. These commercial developments showed that adherence to the project approved by Congress would be inexpedient and would accomplish no results useful to navigation; and that a

modification of the project would be desirable, looking to the excavation of a channel 12 feet deep down to Conners Island, and omitting the work proposed below that point to Port Day. For these reasons expenditure of the appropriation of July 13, 1892, has, under the authority of the Secretary of War, been suspended until further action in the matter may be taken by Congress.

Amount appropriated by act approved July 13, 1892	$20,000.00
July 1, 1893, balance unexpended	20,000.00

(See Appendix P P 6.)

7. Wilson Harbor, New York.—The project for the improvement of this harbor was adopted in 1873 and modified in 1877, the object being to afford a channel of navigable width and 12 feet in depth by the extension of parallel piers from the mouth of Twelve Mile Creek to the 12-foot curve in Lake Ontario, with the formation of a protected channel between the piers. The mouth of the creek was originally obstructed by a bar, upon which there was a depth of 1 foot. Before the commencement of operations by the United States the piers had been carried about 400 feet into the lake by private enterprise.

The total amount expended to June 30, 1893, was $64,978.51.

July 1, 1892, balance unexpended	$21.49
July 1, 1893, balance unexpended	21.49
Amount (estimated) required for completion of existing project	13,978.49
Amount that can be profitably expended in fiscal year ending June 30, 1895	27,455.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix P P 7.)

8. Olcott Harbor, New York.—The project for the improvement of this harbor was adopted in 1866. It proposes to connect the deep water in Lake Ontario with the deep water in Eighteen Mile Creek, by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the addition of a dredged channel between the piers. The project was modified in 1874 and in 1881, to provide for the removal of rock found in the channel between the piers and for additional pier extension. The natural channel between the mouth of the creek and the lake was obstructed by a bar, upon which there was a depth of 1½ feet. The final project, adopted June 18, 1891, definitely fixes the length of the piers at 850 and 873 feet, respectively, and provides for a channel 180 feet wide, between the piers, decreasing in width to 98 feet at the Main Street Bridge, crossing Eighteen Mile Creek, with a depth of 13.5 feet at mean lake level.

There was no work done during the year. The total amount expended up to June 30, 1892, was $157,503.77. The amount expended during the fiscal year ending June 30, 1893, was $60.

July 1, 1892, balance unexpended	$5,496.23
June 30, 1893, amount expended during fiscal year	60.00
July 1, 1893, balance unexpended	5,436.23
July 1, 1893, outstanding liabilities	15.00
July 1, 1893, balance available	5,421.23

(See Appendix P P 8.)

9. Oak Orchard Harbor, New York.—The earliest project for the improvement of this harbor was adopted in 1836, the date of the first appropriation, and proposed the construction of an east and west break-

water, approaching to within 200 feet of each other, and connecting at the opening with two parallel piers extending into the lake.

Subsequent modifications were extensions to the original project to provide for removal of rock and to adjust the harbor to the increased demand of commerce. The present project was adopted in 1881, the object being to extend the piers to the 12-foot curve in the lake, with the formation of a channel of navigable width and 12 feet deep at low water between the piers. The natural entrance into Oak Orchard Creek was narrow, with a depth of 2 to 4 feet.

A shore protection 91 feet long was built in 1888 to the east of the east pier.

The total amount expended up to June 30, 1892, was $204,477.66. The amount expended during the fiscal year ending June 30, 1893, was $30.

July 1, 1892, balance unexpended	$522.34
June 30, 1893, amount expended during fiscal year	30.00
July 1, 1893, balance unexpended	492.34
July 1, 1893, outstanding liabilities	8.00
July 1, 1893, balance available	484.34

(See Appendix P P 9.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *Dunkirk Harbor, New York, with a view of securing 16 feet of water*, required by act of July 13, 1892, was made by the local engineer, Maj. E. H. Ruffner, Corps of Engineers, and his report thereon was submitted August 5, 1892, through the division engineer, Col. Henry L. Abbot, Corps of Engineers. Maj. Ruffner considers the improvement proposed worthy of being made by the United States; but it is the opinion of the division engineer, concurred in by this office, that Dunkirk Harbor is not worthy of improvement by the General Government to the extent of securing 16 feet depth of water. The report was transmitted to Congress and printed as House Ex. Doc. No. 119, Fifty-second Congress, second session. (See also Appendix P P 10.)

IMPROVEMENT OF HARBORS ON LAKE ONTARIO EAST OF OAK ORCHARD, NEW YORK.

This district was in the charge of Capt. Dan C. Kingman, Corps of Engineers; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Charlotte Harbor, New York.—The original project for the improvement of this harbor, adopted in 1829, proposed to connect the deep water in the Genesee River with the deep water in the lake by parallel piers or jetties about 480 feet apart. The present project, adopted in 1881, is to extend the jetties to the 15-foot curve in the lake, and to dredge a channel between them of navigable width and 15 feet in depth at low water. The natural channel was tortuous, and in calm weather would, at ordinary stages of the lake, admit vessels drawing 8 feet.

The total amount expended from 1828 to June 30, 1893, is $481,679.29. The amount expended from the adoption of the present project in 1881 to June 30, 1893, is $163,600.97.

The total expenditures have resulted in extending the jetties to the 13-foot curve in the lake, and in securing, by dredging, a channel be-

tween them 2,700 feet long, 15 feet deep at extreme low water, and 380 feet wide throughout. Lumber, stone, iron, and other material required for extending the west jetty about 500 feet have been purchased during the present fiscal year, and the work of sinking the cribs is now in progress.

The expenditure has also sufficed for the protection, preservation, and repair of existing works, and for the renewal of the perishable portions from the beginning of the work till the present time.

Though the deep water between the jetties is 15 feet, yet as they have only been extended to the 13-foot curve the full measure of the improvement is not available and can not be until the project is completed.

During the year 25,220 cubic yards of material has been dredged from the channel, and 3,920 cubic yards from a trench in prolongation of the west jetty, in which 2,558 cubic yards of stone has been deposited to form the foundation of the proposed extension.

July 1, 1892, balance unexpended	$11,553.40
Amount appropriated by act approved July 13, 1892	25,000.00
	36,553.40
June 30, 1893, amount expended during fiscal year	23,759.47
July 1, 1893, balance unexpended	12,793.93
July 1, 1893, outstanding liabilities	402.43
July 1, 1893, balance available	12,391.50
Amount (estimated) required for completion of existing project	109,650.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	75,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix Q Q 1.)

2. Pultneyville Harbor, New York.—The project for the improvement of this harbor was adopted in 1870 (the date of the first appropriation), and proposed the construction of a timber breakwater running eastward from the west shore and then northward as a jetty into the lake, also an east jetty parallel to and about 200 feet from the west one, and a dredged channel between them.

The project was modified in 1875 to provide for increased dredging. The object of the improvement was to provide a channel of navigable width and not less than 10 feet deep through the bar and into the mouth of Salmon Creek, which was the harbor. The natural channel was not more than 2 feet deep.

In 1884 it was proposed, in order to make the dredging of permanent value and effect, to build a sand-tight structure parallel to the breakwater and about 100 feet from it between it and the beach, so as to arrest the movement of the beach sand and keep it out of the channel.

The total amount expended to June 30, 1893, is $73,937.09, and has resulted in the extension of the jetties to the 10-foot curve in the lake, and in the construction of about 200 feet of sand-tight bulkhead, and in a large amount of dredging in the channel. The last work of this kind was done by the United States dredging plant belonging to this district during the month of May, 1893. Ten thousand seven hundred and six cubic yards of material was removed, forming a good channel from the lake between the piers and up the creek as far as the wharves and warehouses. This channel has a general depth of about 10 feet at low water in the lake.

The depth diminishes somewhat in the extreme inner portions of the

harbor on account of the rock bottom. Since the construction of the sand-tight bulkhead there is reason to hope that this channel will be much more permanent than the former works.

The superstructure of the breakwater and of a greater part of the jetties is now very much decayed.

July 1, 1892, balance unexpended	$369.23
Amount appropriated by act approved July 13, 1892	1,000.00
	1,369.23
June 30, 1893, amount expended during fiscal year	1,306.32
July 1, 1893, balance unexpended	62.91
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	9,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q Q 2.)

3. Harbor at Great Sodus Bay, New York.—The earliest project for the improvement of this harbor, adopted in 1828, proposed the construction at the mouth of the bay of breakwaters from the east and west shores, approaching to within 500 feet of each other and connected at the opening with parallel jetties extending into the lake.

The subsequent modifications were simply extensions of the original project to adjust it to the increased demands of commerce. The present project was adopted in 1882, the object being to extend the jetties to the 15-foot curve in the lake, and to dredge a channel between them not less than 15 feet deep at extreme low water. The natural channel at ordinary stages would admit vessels drawing 8 feet.

The total amount expended from 1829 to June 30, 1893, is $449,016.35. The amount expended from 1881 to June 30, 1893, is $77,244.61.

The total expenditure has resulted in the construction of a timber breakwater 3,851 feet in length, and of two jetties 1,580 feet and 1,294 feet in length, the west one extending to the 15-foot curve in the lake and the east one to the 10-foot curve.

It has also served for the protection, preservation, and repair of these works from 1829 to the present time, and for dredging from time to time, which has served to maintain a channel of navigable width between the jetties which has varied at different times from 8 to 15 feet in depth at low water.

The present available depth is not less than 15 feet at extreme low water, but the channel has not yet received the desired width.

The United States dredging plant belonging to this district is now at work here, and the channel will be widened and improved as far as the funds available will allow.

July 1, 1892, balance unexpended	$1,537.74
Amount appropriated by act approved July 13, 1892	15,000.00
	16,537.74
June 30, 1893, amount expended during fiscal year	12,927.35
July 1, 1893, balance unexpended	3,610.39
July 1, 1893, outstanding liabilities	1,206.18
July 1, 1893, balance available	2,404.21
Amount (estimated) required for completion of existing project	43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q Q 3.)

4. Harbor at Little Sodus Bay, New York.—The first project for the improvement of this harbor was adopted in 1829 and has since been variously modified.

The first appropriation was made in 1852. The first project proposed to partially close the opening between the bay and the lake by lateral dikes connected with two parallel jetties extending into the lake.

The present project, which is simply an expansion of the earlier ones, was adopted in 1881 and is designed to afford a channel of navigable width and not less than 15 feet deep at low water by extending the jetties and dredging between them. The original entrance into the bay had a depth of about 1½ feet at extreme low water.

The total amount expended from the date of the first appropriation in 1852 to June 30, 1893, is $310,511.42.

The amount expended from the adoption of the present project in 1881 to June 30, 1893, is $66,069.65.

The total expenditure has resulted in the construction of 5,989 feet of dikes and jetties, which completes the dike work and extends the jetties to the 12-foot curve in the lake. It has also served for the protection, preservation, and repair of these works from the time they were built to the present time.

The available depth of water in the jettied channel is about 12 feet at low water. Effort has been made in the past to increase this depth by dredging. The material to be removed consists mainly of hardpan, which proved to be very difficult to excavate. It was not found economical to attempt to remove it with a dredge alone. It will have to be first broken up with explosives.

This work will be undertaken this season and carried as far as the funds available will allow.

July 1, 1892, balance unexpended	$1,741.86
Amount appropriated by act approved July 13, 1892	6,000.00
	7,741.86
June 30, 1893, amount expended during fiscal year	1,311.51
July 1, 1893, balance unexpended	6,430.35
Amount (estimated) required for completion of existing project	$52,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q Q 4.)

5. Oswego Harbor, New York.—The earliest project for the improvement of this harbor was adopted in 1827, and proposed to inclose an area at the mouth of the Oswego River by extending jetties from the shore into the lake, joining the outer ends by a breakwater and leaving an opening through which to enter the harbor.

This project was completed in 1869, and forms the present inner harbor.

The present project was adopted in 1870, and consists of a breakwater 5,800 feet in length, generally parallel to the old west breakwater, and 1,100 feet in advance of it. The estimated cost was $1,161,682. This estimate of course did not include its subsequent repair and maintenance. This project was afterward modified by the proposed construction of an east breakwater 2,700 feet in length, the re-

duction to 350 feet of the opening between the east end of the west breakwater and the north end of the light-house pier, the construction of spurs along the face of the outer west breakwater to reduce the effect of accumulated seas, and to provide for deepening by dredging the inner harbor at the mouth of the Oswego River.

The act of Congress of August 11, 1888, provided for the removal of the outer east breakwater, of which 250 feet had been built.

This has been done, and the construction of an east breakwater now forms no part of the project.

In 1890 the project was further modified by providing for the protection and permanent maintenance of an opening that had been formed by waves in a storm through the outer breakwater near the western angle; the object of this opening being to keep the water in the harbor pure by allowing a circulation through, and to provide another entrance for small vessels. The natural entrance to the mouth of the river was shallow and difficult of access, and afforded very little shelter to vessels of any considerable size.

The sundry civil act approved March 3, 1893, authorized the unexpended balance of the current appropriation to be applied to the removal of rock within the harbor lines to a uniform depth.

A project was therefore prepared for the removal of about 3,000 cubic yards of solid rock from the bed of the river near its mouth, so as to secure a uniform depth of 15 feet at extreme low water in this portion of the harbor. This work is now in progress.

The object of all these improvements has been to give protection and shelter to the city docks and wharves and to the commerce of the harbor, and to make a depth suitable for the deepest draft vessels on the lake.

The total amount expended from the adoption of the project to June 30, 1893, is $1,786,812.75. The amount expended from the adoption of the present project in 1870 is $1,316,431.88.

The total expenditure has resulted in the completion of the original project of 1827, and in the construction of the outer west breakwater; the reduction to 350 feet of the opening between the east end of this breakwater and the north end of the light-house pier, the construction and removal of about 250 feet of the east breakwater, the completion of two spur cribs, and the deepening of the river mouth to a depth of 15 feet at low water; in the securing full protection to the dock and wharves west of the river mouth, and channels of entrance 16 feet deep and 350 feet wide to the inner and outer harbors, and in securing increased depth in the inner harbor.

In addition, the various works have been cared for and maintained, and the perishable portions renewed, when necessary, from the beginning of the work in 1829 to the present time.

The operations of the fiscal year have been the renewal of the superstructure on the light-house pier extension, in the parapet form, for a length of about 342 feet; leaving about 90 feet to be done in order to complete it. This will be done this season.

There has already been removed from the harbor near the river mouth about 2,500 cubic yards of solid rock measured in place. This will enable vessels drawing 15 feet to reach at the lowest stage of the lake a coal trestle and elevators before inaccessible.

Minor repairs have also been made as required to the piers and breakwater.

July 1, 1892, balance unexpended	$5,788.56
Amount appropriated by act approved July 13, 1892	40,000.00
	45,788.56
June 30, 1893, amount expended during fiscal year	26,970.44
July 1, 1893, balance unexpended	18,818.12
July 1, 1893, outstanding liabilities	3,953.80
July 1, 1893, balance available	14,864.32
Amount (estimated) required for completion of existing project	85,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	85,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q Q 5.)

6. Harbor at Sacketts Harbor, N. Y.—The project for the improvement of this harbor was adopted in 1881, and proposed the deepening of the harbor by dredging over an area of about 15 acres to a depth of 12 feet at low water. The depth previously existing was less than 8 feet over a large part of this area.

In 1826 and 1828 the sum of $6,000 was expended in clearing and deepening this harbor. The total amount expended from 1826 to June 30, 1893, is $14,406.01. The amount expended from the adoption of the present project to June 30, 1893, is $8,406.01, and has resulted in the removal of 24,010 cubic yards of sand, mud, and gravel from the harbor, and in the construction of a stake and fascine dike 164 feet in length, with a mooring crib 18 feet square at its extremity to shelter the basin and exclude gravel drift from it. With the completion of this work the harbor has a depth of 12 feet at low water over about 6 acres of its area, except in a small place where the presence of rock in place limited the depth to a little less than 12 feet.

July 1, 1892, balance unexpended	$449.26
June 30, 1893, amount expended during fiscal year	38.00
July 1, 1893, balance unexpended	411.26
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix Q Q 6.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination for *harbor of refuge in Mexico Bay, on Lake Ontario, New York*, required by act of July 13, 1892, was made by the local engineer, Capt. Dan. C. Kingman, Corps of Engineers, and his report thereon, dated November 11, 1892, submitted through the division engineer, Col. Henry L. Abbot, Corps of Engineers. Capt. Kingman considers that the value of such a harbor is, to a certain extent, measured by the value of all the commerce on Lake Ontario, but that the question as to whether or not it ought to be built depends largely upon its cost, to make an estimate of which would require a survey costing about $1,000. It is the opinion of the division engineer,

concurred in by this office, that the improvement is not worthy of being made by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 118, Fifty-second Congress, second session. (See also Appendix Q Q 7.)

IMPROVEMENT OF RIVERS AND HARBORS IN VERMONT AND NORTHERN NEW YORK.

This district was in the charge of Maj. M. B. Adams, Corps of Engineers, to December 10, 1892, and of Capt. Smith S. Leach, Corps of Engineers, since that date; Division Engineer, Col. Henry L. Abbot, Corps of Engineers.

1. Shoals between Sister Islands and Cross-over Light, St. Lawrence River, New York.—The act of August 11, 1888, provided for a survey of the shoals described, which being made, a report was submitted July 2, 1889, and printed in the Annual Report of the Chief of Engineers, 1889, pp. 2463 and 2464. The estimate of cost was $43,305 for a total volume of 2,077 cubic yards of rock to be removed, affording a draft of 18 feet at low water.

Appropriations of $5,000 in 1890 and $10,000 in 1892 were made. A contract already completed and another now pending will consume the $15,000 appropriated and will accomplish the removal of the two smaller of the three shoals included in the project. Two outlying spurs of one of these shoals, not detected by the first survey, have been included in the project, increasing it to 2,627 cubic yards, and a pro rata revised estimate of $54,772 has been adopted.

July 1, 1892, balance unexpended	$4,909.44
Amount appropriated by act approved July 13, 1892	10,000.00
	14,909.44
June 30, 1893, amount expended during fiscal year	8,198.43
July 1, 1893, balance unexpended	6,711.01
July 1, 1893, amount covered by uncompleted contracts	4,500.00
July 1, 1893, balance available	2,211.01
Amount (estimated) required for completion of existing project	39,772.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	39,772.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 1.)

2. Ogdensburg Harbor, New York.—The improvement of this harbor has been carried on under three successive projects, covering substantially the same area, but providing for a progressive deepening to meet the increasing demand of commerce for draft of water. The last of these projects now in progress of execution was adopted in 1890, and contemplates the deepening of the channels leading from the deep water of the St. Lawrence River and along the city front to 16½ feet at extreme low water, at an estimated cost of $158,950. Prior to improvement, depths of 5 to 12 feet prevailed along the city front. There is now a channel 150 feet wide with a clear depth of 16½ feet at extreme low water along the greater part of the city front, with two entrances of equal or greater depth from the river. The completion of a contract now pending will extend the channel with the same dimensions to and across the mouth of the Oswegatchie River and deepen a third entrance at the upper end. All moneys appropriated, not heretofore expended, are pledged under the present contract.

July 1, 1892, balance unexpended		$27,556.23
Amount appropriated by act approved July 13, 1892		40,000.00
		67,556.23
June 30, 1893, amount expended during fiscal year		22,862.22
July 1, 1893, balance unexpended		44,694.01
July 1, 1893, outstanding liabilities	$10,127.11	
July 1, 1893, amount covered by uncompleted contracts	28,534.89	
		38,662.00
July 1, 1893, balance available		6,032.01
Amount (estimated) required for completion of existing project		70,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		70,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

(See Appendix R R 2.)

3. Breakwater at Rouse Point, Lake Champlain, New York.—The project of this improvement was adopted in 1885, and comprised a straight breakwater composed wholly of stone, with a total length of about 2,000 feet, reaching the 18-foot curve in the lake. The estimated cost was $110,000.

To the close of the last fiscal year operations had been carried on under four contracts, made in 1885, 1886, 1888, and 1890, and 1,700 feet of the structure had been completed.

The 18-foot curve was then 125 feet from the unfinished end and it was therefore decided to terminate the breakwater with an extension of 135 feet, and with a total length of 1,835 feet.

The original estimate of cost was $110,000, or $55 per linear foot. The appropriations of the years above noted aggregated $83,500 and in the act of July 13, 1892, the sum of $15,000 was appropriated, that being the estimated cost of the proposed extension. With the total of $98,500 appropriated the project will be completed, the actual cost being somewhat less than $54 per linear foot. Under the last appropriation of $15,000 a contract was entered into for the 135 feet extension, work to be begun November 1, 1892, and completed November 30, 1893. At the close of the fiscal year the rubble foundation and core were in place and the setting of the large stones in the superstructure had begun.

July 1, 1892, balance unexpended		$7.97
Amount appropriated by act approved July 13, 1892		15,000.00
		15,007.97
June 30, 1893, amount expended during fiscal year		4,738.86
July 1, 1893, balance unexpended		10,269.11
July 1, 1893, outstanding liabilities	$2,148.69	
July 1, 1893, amount covered by uncompleted contracts	8,120.42	
		10,269.11

(See Appendix R R 3.)

4. Great Chazy River, New York.—A survey of this stream from its mouth, on Lake Champlain, to Champlain Village was provided for in the act of 1888. The report made was printed in the Report of the Chief of Engineers for 1889, p. 2466.

The project adopted was to dredge a channel between the points named in the act 40 feet wide and 5 feet deep, at a cost of $18,000. The act of 1890 appropriated $10,000 to this improvement, which was expended under contract in accordance with the project.

An appropriation of $5,000 was made in the act of 1892, which has also been placed under contract and will be expended by November 30, 1893.

Amount appropriated by act approved July 13, 1892		$5,000.00
June 30, 1893, amount expended during fiscal year		30.17
July 1, 1893, balance unexpended		4,969.83
July 1, 1893, outstanding liabilities	$165.00	
July 1, 1893, amount covered by uncompleted contracts	4,804.83	
		4,969.83

Amount (estimated) required for completion of existing project	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 4.)

5. Plattsburg Harbor, New York.—This work has been intermittently prosecuted since 1836. Under the project then adopted, and subsequent modifications, a breakwater of a permanent and substantial character, 1,850 feet in length, has been completed. This structure is believed to afford sufficient shelter for the present needs of commerce. In addition to the breakwater, some dredging has been done in the anchorage and a short length of wasting beach has been protected. The total cost of the improvement has been $122,412.03.

July 1, 1892, balance unexpended	$15,275.34
June 30, 1893, amount expended during fiscal year	15,007.37
July 1, 1893, balance unexpended	267.97

(See Appendix R R 5.)

6. Burlington Harbor, Vermont.—This improvement dates from 1836, modifications of the original plan having been made from time to time, so as to afford adequate protection to the increasing commercial and shipping interests of the harbor. The last modification, made in 1886, provides for further extension of the breakwater, both to the north and to the south, with its gradual withdrawal as it is prolonged, into water about 30 feet deep, instead of 38 feet deep, so as to reduce the cost.

The old parts of the under superstructure are much decayed, and the balance of the appropriation of September 19, 1890, $15,691.83, will be expended in repairs, as also the additional funds asked for, if appropriated.

July 1, 1892, balance unexpended	$15,759.89
June 30, 1893, amount expended during fiscal year	68.06
July 1, 1893, balance unexpended	15,691.83

Amount (estimated) required for completion of existing project	129,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 6.)

7. Otter Creek, Vermont.—The object of this improvement is to afford a channel of navigable width and a depth of 8 feet at low water from the town of Vergennes, Vt., to Lake Champlain. The original project was adopted in 1872, and was estimated to cost $58,146. In 1882 surveys developed the fact that rock in situ would be encountered within the proposed limits of width and depth, and the estimate was increased to $73,748.40. In 1884 a relocation of the channel at Bull Brook Bend avoided part of the rock excavation, reducing the cost by about $500, and the lower prices which have prevailed in recent years have insured the completion of the project for less than the revised estimate of 1882.

Occasional expenditures for maintenance will doubtless be required. It has been found necessary to repeat operations at Bull Brook Bend,

and it is quite probable that accretions will again occur on the shoals there and elsewhere during the season of freshets. Such costs of maintenance will not, it is believed, be excessive in relation to the first cost of the improvement, and they will be very small as compared with the traffic benefited.

Under the act of 1892 the rock excavation near the Reform School Dock at Vergennes was twice advertised and placed under a contract, insuring the completion of the work proposed with the funds available.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	259.75
July 1, 1893, balance unexpended	9,740.25
July 1, 1893, amount covered by uncompleted contracts	9,740.25

(See Appendix R R 7.)

8. Ticonderoga River, New York.—The project for this improvement was adopted in 1881, its object being to afford a channel of navigable width and a least depth of 8 feet at low water from Ticonderoga village to Lake Champlain, a distance of about 2 miles. The original estimated cost of the improvement was $42,516.

The appropriation of September 19, 1890, $2,000, was expended under contract, and operations consisted in the dredging and removal of 8,132 cubic yards of material from shoals near the mouth of the river.

The work done under the small appropriation of 1890 was of substantial benefit, though it has lost some of its efficacy through deterioration.

Amount (estimated) required for completion of existing project	$26,016.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	26,016.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix R R 8.)

9. Narrows of Lake Champlain, New York and Vermont.—The original project for this work was adopted in 1885, and had for its object the removal of such obstructions in the channel between Whitehall, N. Y., and a point a mile below, known as the Elbow, as would afford a least depth of 12 feet with a least width of 150 feet, and the dredging of the channel along Cedar Mountain and across Kenyon Bay so as to afford a least depth of 12 feet and a width of 200 feet. The estimated cost was $80,000.

Under appropriations in 1886 and 1888, aggregating $45,000, the project was completed, and the resulting channel being found deficient in width at certain sharp bends, a supplementary project was adopted, involving dredging, at an estimated cost of $21,000.

The act of 1892 contained an appropriation of $18,500, making, with the balance in hand, a sum sufficient to complete the project, which has been placed under contract. Nothing was done during the fiscal year. Operations will begin soon after its close and will be completed by November 30, 1893.

July 1, 1892, balance unexpended	$2,290.04
Amount appropriated by act approved July 13, 1892	18,500.00
	20,790.04
June 30, 1893, amount expended during fiscal year	28.88
July 1, 1893, balance unexpended	20,761.16
July 1, 1893, amount covered by uncompleted contracts	16,300.00
July 1, 1893, balance available	4,461.16

(See Appendix R R 9.)

10. Breakwater construction in Lake Champlain.—In compliance with instructions from this office, Maj. M. B. Adams, Corps of Engineers, then in charge of works in that district, submitted a comprehensive report and discussion upon the subject of breakwater construction in Lake Champlain, which, together with remarks thereon by officers who have had experience with similar works on the Great Lakes, is submitted herewith as Appendix R R 10.

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. M. B. Adams, Corps of Engineers, and reports thereon submitted through the division engineer, Col. Henry L. Abbot, Corps of Engineers:

1. North Hero Harbor, on Lake Champlain, Vermont.—Maj. Adams submitted report of examination under date of September 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 112, Fifty-second Congress, second session. (See also Appendix R R 11.)

2. Harbor at Adams (Tobias) Landing, on Grand Isle, Vermont.—Maj. Adams submitted report of examination under date of September 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 64, Fifty-second Congress, second session. (See also Appendix R R 12.)

PACIFIC COAST.

IMPROVEMENT OF OAKLAND HARBOR, CALIFORNIA.

This work was in the charge of Col. G. H. Mendell, Corps of Engineers, having under his immediate orders Lieut. Clement A. F. Flagler, Corps of Engineers, the entire year, and Lieut. H. C. Newcomer, Corps of Engineers, to August 20, 1892.

The principal features of this improvement as originally projected are (1) two mid-tide training walls of rubblestone extended from the shore westward into San Francisco Bay about 2 miles; (2) a connection by a canal 1½ miles in length with the estuary of San Leandro; (3) a dam at the mouth of this estuary; (4) dredging of basins and channels to give a depth of 20 feet at low tide, which at high tide will accommodate vessels of the largest class.

Two modifications of the original project have been adopted, namely, to increase the width of tidal canal from 300 to 400 feet, and to raise the height of jetties from half-tide level to full high water.

In the original condition of the entrance the low-water channel depth was about 2 feet, admitting at time of high tide vessels drawing 6 to 8 feet of water. The present navigable condition is a convenient channel from the Bay of San Francisco to and along the city front 300 feet in width and 14 feet in depth at low water, admitting vessels at high water of 19 feet draft.

The channel in the upper bay is 200 feet wide and 8 feet deep at low water. These depths have been well maintained during the year.

Along the front of the city of Oakland the channel was widened during the past year from 225 to 300 feet, and this strip of 75 feet width was excavated to 18 feet at low water. This is an advantage for convenience of navigation.

The channel in the upper bay has been increased in depth and the general facilities for commerce and navigation have been enlarged.

Each year shows the benefit of improvements in the entry of larger vessels.

The other operations of the year, namely the excavation of a portion of the canal and the addition to the south jetty, are in continuation of the project but have no immediate bearing upon commercial facilities.

The amount expended to June 30, 1893, is $1,551,644.14.

The quantity of dredging during the year is 418,732 cubic yards, of which 102,441 yards applied to the excavation of the canal, completing the contract; 155,119 yards to widening and deepening the channel in front of the wharves of Oakland, completing the contract; and 161,172 yards to excavation of the upper channel in front of Brooklyn, contract nearly completed. All of the spoil was securely placed ashore.

A contract made on October 8, 1892, for giving 20 feet depth in front of Oakland, not yet begun, is to be completed by April 14, 1894.

The quantity of work done on the south jetty is included in 7,676 tons of stone delivered and in 20,684 square feet of dry masonry. Contract not yet half finished.

The contemplated operations for the coming year include deepening the channel in front of Oakland already provided for by contract; in enlarging the channel of the entrance, in extension of the south jetty, and in case of sufficient funds becoming available, a continuation of work upon the canal.

July 1, 1892, balance unexpended		$82,419.30
Amount appropriated by act approved July 13, 1892		150,000.00
		232,419.30
June 30, 1893, amount expended during fiscal year		99,463.44
July 1, 1893, balance unexpended		132,955.86
July 1, 1893, outstanding liabilities	$4,797.73	
July 1, 1893, amount covered by uncompleted contracts	122,419.94	
		127,217.67
July 1, 1893, balance available		5,738.19

Amount (estimated) required for completion of existing project	841,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	350,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix S S 1.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examination of *entrance to harbor of San Francisco, Cal., known as Golden Gate*, required by act of July 13, 1892, was made by the local engineer, Col. G. H. Mendell, Corps of Engineers, and his report thereon, dated July 27, 1892, submitted. It is his opinion, concurred in by this office, that the entrance, being now unexceptionable, is not worthy of improvement by the General Government. The report

was transmitted to Congress and printed as House Ex. Doc. No. 90, Fifty-second Congress, second session. (See also Appendix S S 2.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHWESTERN ARIZONA AND IN CALIFORNIA SOUTH OF SAN FRANCISCO.

This district was in the charge of Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, having under his immediate orders Lieut. Charles L. Potter, Corps of Engineers, the entire year, and Lieut. James J. Meyler, Corps of Engineers, to October 10, 1892.

1. Napa River, California.—The project is to clear the river of snags and the banks of overhanging trees interfering with navigation, and to dredge the bars between Carr Bend and Vernon Mills in the immediate vicinity of Napa.

Work upon this improvement was commenced in 1889. The river was cleared of snags, and the channel was dredged from Carr Bend to the highway bridge at Third street. The work completed two years ago left the river in good boating condition. It is not considered that any improvement effected can be permanent. Floods in the river caused by the winter rains bring down large quantities of detritus which lodges in the river and forms shoals. The channel, dredged two years ago, has been partially refilled from material brought down during a heavy freshet last December.

The total amount appropriated for this improvement is $17,500, and the total amount expended is $17,480.65.

No work was done during the past season. The amount of $10,000 is asked for the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended	$41.43
June 30, 1893, amount expended during fiscal year	22.08
July 1, 1893, balance unexpended	19.35
Amount (estimated) require for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 1.)

2. Redwood Creek, California.—This improvement is a continuation of that heretofore carried on under appropriations made for the improvement of Redwood Harbor. The creek has been dredged several times, the object being to provide a channel 50 feet wide and 3 feet deep at low tide from the lower end of the tannery bend to the wharves at Redwood, a distance of about 6,000 feet. From the tannery bend to the Bay of San Francisco, distant about 6 miles, a good navigable channel exists for the class of vessels engaged in the trade with Redwood City.

Dredging was in progress at the beginning of the fiscal year with the balance available from the appropriation of $8,000 made by the river and harbor act of September 19, 1890. The work was continued during July and August, and the dredged channel completed.

The improvement can not be considered of a permanent character, as owing to natural causes there is a constant tendency to shoaling. An examination recently made by the officer in charge shows that as expected the dredged channel has partially refilled, though a well defined cut existed around the tannery bend capable of affording navigation during the higher stages of tide.

No appropriation is asked for the coming fiscal year. Funds may be needed in the future to continue the dredging as the condition of the channel may warrant and the commerce justify.

The total amount appropriated for dredging at Redwood is $23,400, of which $8,000 was for Redwood Creek, and the total amount expended to the close of the fiscal year, including outstanding liabilities, is $23,386.49.

July 1, 1892, balance unexpended	$2,708.18
June 30, 1893, amount expended during fiscal year	2,694.67
July 1, 1893, balance unexpended	13.51

(See Appendix T T 2.)

3. San Luis Obispo Harbor, California.—The project for this improvement is intended to protect the anchorage and landing at Port Harford by the construction of a breakwater on Whaler Reef, extending from Point San Luis to Whaler Island, and thence to a point where the outer reef rises above high water. The total length of the structure, when completed, including the island, will be about 2,300 feet. The breakwater will rise to a height of 6 feet above high tide with such slopes in front and rear as may be assumed under the action of the seas.

That portion of the breakwater between the point and the island, about 300 feet in length, is practically completed, and work has been commenced upon the extension beyond the island and carried an additional length of 340 feet. In addition, several thousand tons have been deposited in the deeper portions of the reef, on the line of the structure outside. The present completed length of breakwater is about 900 feet.

At the commencement of the fiscal year work was in progress under contract with the San Francisco Bridge Company. This work was completed in August, the contractor having delivered and placed in position 2,812.77 tons during the two months.

Work is now being continued with the appropriation of $30,000 made by river and harbor act of July 13, 1892. After advertising, in the usual manner, a contract was entered into with A. A. Polhamus, April 22, for rock in place at $1.94 per ton. The above amount will permit the delivery of about 15,000 tons, which will extend the breakwater an additional 400 feet. Owing to the inefficient plant provided by the contractor, but little progress was made at the close of the fiscal year. The changes now being made in the outfit will cause a more rapid progress to be made in the future.

As the breakwater advances seaward the depth of water on the reef on the line of the structure becomes greater, reaching finally 30 feet at mean low water.

The original project contemplated first filling up the gaps in the reef and raising the breakwater to the plane of mean low water, and afterwards raising it higher, if deemed advisable. The conditions arising from the almost constant swell across the reef, making it difficult and dangerous to deposit rock from barges direct upon the reef, as well as the increased expense of these operations, caused the officer in charge to recommend that the project be changed so as to permit the breakwater to be built continuously above high water as the work proceeded, the material being deposited in place from trestle work built from the shore. A revised project with estimate to carry on the work in this manner was submitted and approved.

The total amount appropriated for this improvement is $95,000, and the total amount expended is $66,864.90.

July 1, 1892, balance unexpended		$19,646.77
Amount appropriated by act approved July 13, 1892		30,000.00
		49,646.77
June 30, 1893, amount expended during fiscal year		20,730.51
July 1, 1893, balance unexpended		28,916.26
July 1, 1893, outstanding liabilities	$781.16	
July 1, 1893, amount covered by uncompleted contracts	26,818.84	
		27,600.00
July 1, 1893, balance available		1,316.26

Amount (estimated) required for completion of existing project	508,660.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 3.)

4. Wilmington Harbor, California.—Previous to the commencement of this improvement in 1871, there was a depth of less than 2 feet at the entrance at low tide. Since that time the operations of dredging and jetty construction have secured a depth of 16 feet at mean low tide in the inner harbor, and a depth of over 14 feet at the entrance. The present project is intended to secure a depth of 16 feet at same stage, which will permit vessels drawing 21 or 22 feet to enter at high tide. During the past year the ship *Big Bonanza*, drawing 18.8 feet, entered the harbor and unloaded at the wharves.

During the past year operations have been continued with the appropriation of $51,000 made by river and harbor act of July 13, 1892, combined with the balance of a former appropriation. A contract was entered into with Patrick O'Neil, after due advertisement, for delivering 18,000 tons of rock for the jetties. Under this contract work was continued upon the extension and repair of the jetties. At the close of the fiscal year the contractor had delivered 7,458.7 tons of rock, which was used in strengthening the east jetty inside of Deadmans Island and in the extension seaward of the jetty beyond the island. The line of single work of the east jetty was also raised and strengthened to resist threatened encroachment of the sea.

During the coming season the work of jetty extension will be continued to the extent of the available funds.

With the expenditure of the amount now on hand the present project will be completed. No further appropriation is asked at this time, as it is desired first to ascertain fully the effects of the operations now in progress in securing the desired depth at the entrance. A survey of the entire harbor is now in progress.

The total amount appropriated for this work is $955,000, and the total amount expended to close of fiscal year, including outstanding liabilities, is $918,238.88.

July 1, 1892, balance unexpended		$9,674.58
Amount appropriated by act approved July 13, 1892		51,000.00
		60,674.58
June 30, 1893, amount expended during fiscal year		21,794.10
July 1, 1893, balance unexpended		38,880.48
July 1, 1893, outstanding liabilities	$2,119.36	
July 1, 1893, amount covered by uncompleted contracts	19,978.28	
		22,097.64
July 1, 1893, balance available		16,782.84

(See Appendix T T 4.)

5. San Diego Harbor, California.—Before the adoption of the present project the work carried on at San Diego had for its object the preservation of the harbor, which was being injured by the deposition of material brought down the San Diego River in flood stages. The river was diverted from its course and caused to empty into False Bay. This was accomplished by building a substantial levee across the mouth of the river and excavating a new water way leading to False Bay. This work was completed in 1876.

The present project for the improvement of the harbor contemplates the preservation and repair of the above levee, securing a depth of 26 feet at mean low tide over the outer bar by the construction of a jetty on Zuninga Shoals and dredging and maintaining a channel of 24 feet depth at mean low tide over the shoal at the head of the middle ground.

Jetty.—The ground on Coronado North Island needed, in connection with the construction of the jetty, was recently purchased under an agreement made by the Department with the Coronado Beach Company. Upon the acquisition of the land specifications were issued and proposals invited for the construction of so much of the jetty as the available funds would permit.

During the coming season work will be continued upon the construction of the jetty.

Middle ground.—The dredged channel through the middle ground has shoaled over a narrow crest to a depth of about 16½ feet at mean low water. This shoaling is due to natural causes, the material being brought into the harbor over Zuninga Shoals during flood stages of tide. With the construction of the jetty this movement of sand will be controlled and the material will be impounded behind the jetty. It is not intended to continue operations at the middle ground until the jetty shall have been extended sufficiently far to permit the dredging to be carried on and a permanent channel maintained.

The total amount appropriated for the levee at San Diego Harbor since 1875 is $82,500, and the total amount expended on this work is $82,085.37.

There has been appropriated for the jetty and dredging $110,000, and the amount expended, including purchase of land and outstanding liabilities, is $21,722.90.

The amount of $200,000 is asked for the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended	$50,759.81
Amount appropriated by act approved July 13, 1892	50,000.00
	100,759.81
June 30, 1893, amount expended during fiscal year	12,027.66
July 1, 1893, balance unexpended	88,732.15
July 1, 1893, outstanding liabilities	40.42
July 1, 1893, balance available	88,691.73
Amount (estimated) required for completion of existing project	284,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix T T 5.)

6. Colorado and Gila rivers at Yuma, Ariz.—Prior to the appropriation of $10,000 made by the river and harbor act of July 13, 1892, no survey had been made of the locality upon which to base a project for improvement. An allotment of $500 was accordingly made from the above amount for this purpose.

The survey was completed in October last, and a project was submitted and approved by the Secretary of War, November 25, 1892.

The act requires the construction of a levee along the Gila River, near its junction with the Colorado at Yuma, Ariz., so as to confine the waters to the channels of those rivers.

It is proposed to build a substantial levee along a slough near the eastern boundary of Yuma, extending from the high land on the left bank of the Colorado to an embankment of the Southern Pacific Railroad at the southerly limit of the town. The total length of the levee will be about 3,200 feet.

The right of way for the levee has been obtained from the various property owners free of expense, and the deeds have been placed upon record.

Owing to the intense heat prevailing at Yuma during the summer seasons, the construction of the levee will not be commenced until autumn. Specifications will be issued and proposals invited, so that the work can be carried on at that time.

When completed the levee will fulfill the conditions of confining the waters of the Gila and Colorado to their respective channels and thereby prevent overflow. The officer in charge states, however, that it is not expected that any improvement of the Colorado River will be effected thereby.

The total amount appropriated for this work is $10,000, and the total amount expended is $496.93.

Amount appropriated by act approved July 13, 1892	$10,000.00
July 30, 1893, amount expended during fiscal year	496.93
July 1, 1893, balance unexpended	9.503.07

(See Appendix T T 6.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Lieut. Col. W. H. H. Benyaurd, Corps of Engineers.

1. Navigable slough known as Twelve Mile Creek, in the Bay of San Francisco, California.—Lieut. Col. Benyaurd submitted report under date of October 10, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 91, Fifty-second Congress, second session. (See also Appendix T T 7.)

2. Alviso Slough, California.—Lieut. Col. Benyaurd submitted report of examination under date of October 22, 1892. It is his opinion, concurred in by this office, that the locality is not worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 44, Fifty-second Congress, second session. (See also Appendix T T 8.)

EXAMINATION BY BOARD OF ENGINEERS FOR DEEP-WATER HARBOR AT SAN PEDRO OR SANTA MONICA BAY, CALIFORNIA, IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The river and harbor act approved July 13, 1892, provides as follows:

The Secretary of War is hereby authorized and directed to appoint a board of five engineer officers of the United States Army, whose duty it shall be to make a care-

ful and critical examination for a proposed deep-water harbor at San Pedro or Santa Monica bays, and to report as to which is the more eligible location for such harbor in depth, width, and capacity to accommodate the largest ocean-going vessels and the commercial and naval necessities of the country, together with an estimate of the cost. Said board of engineers shall report the result of its investigations to the Secretary of War on or before the first of November, eighteen hundred and ninety-two.

The board appointed under this provision, consisting of Col. William P. Craighill, Lieut. Cols. Henry M. Robert and Peter C. Hains, and Majs. C. W. Raymond and Thomas H. Handbury, Corps of Engineers, submitted its report under date of October 27, 1892, in which it expresses the following opinion:

Having made a careful and critical examination for a proposed deep-water harbor at San Pedro or Santa Monica bay, as required by law, the board is unanimously of opinion that the location selected by the Board of Engineers of 1890, at the present anchorage at the westerly side of San Pedro Bay, under Point Fermin, is the "more eligible location for such harbor in depth, width, and capacity to accommodate the largest ocean-going vessels and the commercial and naval necessities of the country."

The cost of the necessary breakwater, of the size and character determined upon, is estimated at $2,885,324.

The report was transmitted to Congress and printed as House Ex. Doc. No. 41, Fifty-second Congress, second session. (See also Appendix T T 9.)

IMPROVEMENT OF SAN JOAQUIN AND SACRAMENTO RIVERS AND TRIBUTARIES AND OF RIVERS AND HARBORS IN CALIFORNIA NORTH OF SAN FRANCISCO.

This district was in the charge of Maj. W. H. Heuer, Corps of Engineers; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. San Joaquin River, California.—When a project was first adopted for the improvement of this river, in 1877, there was only a low-water channel to Stockton of about 6 feet in depth, and this was gradually deteriorating. The upper river, above Stockton, was navigable for about six months in the year for light draft boats. The project first adopted was for a channel 9 feet deep to Stockton, secured by dredging the shoal places both in the river and Stockton Channel; the making of cut-offs to straighten the river between Stockton and the mouth; the removal of snags, scraping of bars, and building small wing-dams in the upper river to increase the depth and prolong the boating season. The closure, or partial closure, of several crevasses or sloughs that injured navigation by the amount of water they took from the river has since been added to the project.

At the close of the fiscal year ending June 30, 1892, there had been expended on this project $257,780.55. This expenditure had secured and maintained, severally, a 9-foot channel to Stockton all the year round; had straightened the river by 4 cut-offs, 3 near Devils Elbow and 1 at Head Reach, and made navigation between the cities of San Francisco and Stockton easy and safe. In the upper river Laird Slough and Paradise Cut had been partially closed by dams, but the length of the boating season had not been materially prolonged, as in the low stages of the river, except for a few miles above Stockton Channel, there is not water enough for navigation purposes.

During the fiscal year ending June 30, 1893, the annual dredging necessary to maintain the 9-foot channel to Stockton has been carried on with most successful results, and navigation has been uninterrupted.

The dams both at Paradise Cut and Laird Slough were flanked by the heavy floods and were repaired. The amount spent on the improvements during the fiscal year was $22,925.30, and the results were of great benefit to the commerce of the river.

The right of way necessary for a double cut-off in the narrows, just below Stockton Channel, has been acquired, and bids for doing the work will be opened early in the next fiscal year. At Twenty-one Mile Slough the right of way has also been acquired for a cut-off, which will be shortly made. In both these cases the right of way was acquired free of expense to the United States Government.

The following is a list, in the order of importance, of the works needed for the improvement of this river, together with the estimated cost of the several items:

(1) Dredging to maintain 9 feet depth to Stockton	$35,000
(2) Making cut-off at Twenty-one Mile Slough	65,000
(3) Increasing cut-off at Head Reach in width, depth, or both	37,750
(4) Removing obstruction near county bridge, above Stockton Channel	5,000
(5) Snagging, wing dams, etc.	10.000
Total	152,750

All the above amounts could be advantageously expended in one fiscal year.

July 1, 1892, balance unexpended	$969.45
Amount appropriated by act approved July 13, 1892	65,000.00
	65,969.45
June 30, 1893, amount expended during fiscal year	22,925.30
July 1, 1893, balance unexpended	43,044.15

Amount that can be profitably expended in fiscal year ending June 30, 1895 152,750.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix U U 1.)

2. Mokelumne River, California.—Before improvement navigation in this river was difficult and dangerous on account of numerous bad snags and overhanging trees, and the object of the original project, adopted in 1884, was the removal of such as obstructed navigation.

The river was cleaned out to the head of navigation in 1884, 1885, 1886, 1887, and 1888, and navigation was made easy and safe. It has since deteriorated, but as the act of July 13, 1892, appropriating funds for this river, provided that none should be expended until a drainage canal, dug by private parties near New Hope Landing, should be closed free of expense to the Government, the commencement of the work has been delayed. This canal has now been closed and the improvements will be resumed.

There was expended up to June 30, 1892, on the improvement of this river, $12,457.62, and this resulted in great benefits to navigation. No work has been done during this last fiscal year.

The improvements now needed for the safe navigation of this river are the removal of the snags and trees obstructing navigation, the removal of a point of land near New Hope Landing, and also a shoal formed by the drainage canal. The estimated cost of these works is $9,100, and they could all be done in one fiscal year.

July 1, 1892, balance unexpended	$542.38
Amount appropriated by act approved July 13, 1892	2,500.00
	3,042.38
June 30, 1893, amount expended during fiscal year	23.08
July 1, 1893, balance unexpended	3,019.30
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	9,100.00

(See Appendix U U 2.)

3. Sacramento and Feather rivers, California.—Before improvement navigation in these rivers was dangerous and difficult on account of numerous snags, shallow bars, and rapids. In 1874 a project was adopted having for its object the temporary improvement of the low-water channels by removal of snags, building of wing dams to concentrate currents, and the scraping of bars. Work under this project has been carried on during every working season, and together with the closure of several breaks in the banks, which threatened to injure navigation, cost up to June 30, 1892, $481,680.99. The results of the work were to secure and maintain on the Sacramento River a good navigable channel from McIntosh Landing down to Butte City for boats drawing 2½ feet; from that point to Sacramento 4 feet of water, and below Sacramento a low-water channel with a least depth of 5 feet has been secured. On the Feather River there is a channel from Marysville, the head of navigation, to the mouth for boats and barges drawing 2 feet of water.

At the beginning of the fiscal year the snag boat was at work in the upper Sacramento River, and continued so until November 5, when the channel had been put in good order as far up as Tehama, 29 miles above McIntosh Landing. This opened up 29 miles of river that had not been used by steamboats for over ten years, and gave a channel from Tehama to McIntosh for boats drawing 2½ feet of water. The other channel depths in the river below were maintained as in former years. The cost of the snagging was $13,121.26, and was of the greatest benefit to commerce, in fact without it navigation in the upper Sacramento River could not be maintained.

During this last fiscal year the project was increased to include the closure of Jacob Slough, a large crevasse just above the city of Sacramento; the maintenance of navigation on the Feather River by means of wing dams to remove shoals, and the treatment of the Yuba River, near and above Marysville. Under this project surveys have been made to ascertain the exact conditions existing. Bids were received and opened at the end of the fiscal year for the closure of Jacob Slough, and a project has been made and approved for cutting a new mouth for the Yuba River. No actual work has yet been done, so no results have been attained.

The total amount spent on the improvement of these rivers during the last fiscal year has been $22,856.49, and the result has been of great benefit to the large and increasing commerce of the country adjacent to the rivers. The improvements done on these rivers have resulted in greatly reducing the rates of freight and insurance.

The report of a Board of Engineers appointed to examine these rivers is printed in House Ex. Doc. No. 246, Fifty-first Congress, second session, and in Annual Report, Chief of Engineers, 1891, p. 2990.

July 1, 1892, balance unexpended	$13,319.01
Amount appropriated by act approved July 13, 1892	150,000.00
	163,319.01
June 30, 1893, amount expended during fiscal year	22,856.49
July 1. 1893, balance unexpended	140,462.52
Amount that can be profitably expended in fiscal year ending June 30,1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	345,000.00

(See Appendix U U 3.)

4. Petaluma Creek, California.—In its original condition this creek was very crooked and at low tide its bed, in places, was bare. In 1880, a project was adopted for its improvement by which it was designed to obtain by dredging a channel 50 feet wide by 3 feet deep at low water. For this purpose $35,892.95 was expended up to June 30, 1892, in dredging in the channel and making cut-offs. The channel proposed was obtained and maintained. Much of this work consisted of redredging, as owing to the adjacent country being in a high state of cultivation the dredged channel constantly refills.

The river and harbor act of July 13, 1892, appropriated $10,000 for this work, and to determine where the greatest need for dredging existed a survey of the creek was made and submitted to the Department, together with a project for the expenditure of the funds. It was proposed to carry on work with the United States dredge usually occupied in the San Joaquin River, but at this time idle on account of high water. Accordingly the dredge was put in working order and taken to Petaluma Creek, where it commenced work on May 2, 1893, at Haystack Landing, 3 miles below the town of Petaluma, working upstream. By June 30, a channel 5,107 feet long by 50 feet wide, 3 to 4 feet deep at low water, had been dug, and 37,171 cubic yards of material excavated and placed on the banks 50 to 100 feet back from the cut, at a cost of $4,184.03, or 11.2 cents per cubic yard. The work is still in progress.

The result of the work has been of great benefit to the navigation interests and no serious detentions have been reported of late years. As stated above the channel is continually refilling, and to keep it open dredging must be done every two years at an estimated cost of $4,000.

July 1, 1892, balance unexpended	$107.05
Amount appropriated by act approved July 13, 1892	10,000.00
	10,107.05
June 30, 1893, amount expended during fiscal year	5,394.98
July 1, 1893, balance unexpended	4,712.07
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	53,543.00

(See Appendix U U 4.)

5. Humboldt Harbor and Bay, California.—In its original condition the channels inside this bay were shallow, and great difficulty was experienced in getting shipping to the wharves in Eureka, Arcata, and Hookton. To improve these conditions a project was adopted in 1881 to dredge inside the harbor and obtain a channel to Eureka of 13 feet depth at low water, with a width of 200 feet; also, to obtain a channel to Arcata and Hookton 10 feet deep and 100 feet wide. Work under

this project was commenced in 1881, and the project completed in 1884 at a cost of $96,061.25. These channels have since refilled to some extent, but vessels are not much inconvenienced thereby. Vessels now rarely go to Hookton, but go to Fields Landing, situate in the bay just south of the entrance. It may be necessary in the near future, in the interests of commerce, to improve in width or depth either the Bucksport or the Old West Channel.

In 1882 another project was made to obtain and maintain deeper water across the bar at the entrance. It was proposed to control the tidal flow and secure its scouring effects by means of a training-wall some 6,000 feet long, running out from the south spit. After work was commenced, great scour took place on the north spit, and the project was enlarged to embrace the construction of a jetty on the north spit; also, to build both jetties up to high water and extend them to the 18-foot curve. On account of continued erosion on the north spit the project was again modified, in accordance with the views of a board of engineers, submitted December 16, 1892, the change consisted of relocating the north jetty so as to utilize the shore protection built on the north spit and make it part of the proposed north jetty, and its construction to a sufficient length to arrest erosion before completion of the south jetty; after this both jetties are to be carried simultaneously to the 18-foot curve.

Jetty work was begun in 1889 and carried on until October, 1890, when the contractor failed. At this time the south jetty was built out 2,967.6 feet, 900 feet of which was up to high-water level. In May, 1891, work began again under another contract and continued until December, 1891. Protection work, similar to that used in jetty construction, was built on the north spit and carried out 1,480.5 feet. The south jetty was carried out some additional 600 feet, making it 3,699.2 feet long. This completed the contract.

The cost of jetty work up to this time was $298,325.67. This made the total amount expended on the improvement of this harbor up to June 30, 1892, $394,387.23.

During the calendar year 1892 no work was done, as the funds available were not sufficient to warrant entering into a new contract.

The river and harbor act of July 13, 1892, placed this work under what is known as the continuous-contract system and appropriated for it $150,000. On December 16, 1892, a contract was made to continue operations. In addition to the amounts already available $522,000 was appropriated by the sundry civil act of March 3, 1893. Work was begun in April, 1893, on the north spit, where some damage had been done to the trestle by drift logs, and about 1,000 feet of the shore track washed away. This was repaired and work commenced on the extension of the jetty. Up to June 30, 1893, 14,224 tons of rock and 4,779 cubic yards of brush were delivered, and 832 feet of trestle built.

No work has been done on the south jetty this season. During April and May a few of the outer bents of piling were destroyed, but little or no damage was done to the jetty proper.

On the south spit the sands are accumulating rapidly, it being estimated that 2,000,000 cubic yards have already been arrested by the jetty built there.

Little benefit can as yet be expected from the work done, but the 18-foot channel mentioned in last year's report has remained reasonably permanent, and vessels have not been detained, as formerly, by want of water on the bar.

July 1, 1892, balance unexpended		$28,112.77
Amount appropriated by act approved July 13, 1892		150,000.00
Amount appropriated by sundry civil act approved March 3, 1893		522,000.00
		700,112.77
June 30, 1893, amount expended during fiscal year		19,371.18
July 1, 1893, balance unexpended		680,741.59
July 1, 1893, outstanding liabilities	$21,166.15	
July 1, 1893, amount covered by uncompleted contracts	659,575.44	
		680,741.59

Amount (estimated) required for completion of existing project..... 1,043,115.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix U U 5.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. W. H. Heuer, Corps of Engineers, and reports thereon submitted through the division engineer, Col. G. H. Mendell, Corps of Engineers.

1. San Joaquin River, California, from Hills Ferry to Firebaughs Ferry, including closing of sloughs on the river above Stockton.—Maj. Heuer submitted report of examination under date of September 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that this portion of the river is not worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 20, Fifty-second Congress, second session. (See also Appendix U U 6.)

2. Old River Branch of San Joaquin River, California.—Maj. Heuer submitted report of examination under date of August 23, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is worthy of improvement to the extent of dredging a low-water channel 6 feet deep through the bar at Naglees Ferry. No instrumental survey is necessary for preparation of project and estimate of cost of the work. The report was transmitted to Congress and printed as House Ex. Doc. No. 18, Fifty-second Congress, second session. (See also Appendix U U 7.)

3. Merced River, California.—Maj. Heuer submitted report of examination under date of September 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government at this time. The report was transmitted to Congress and printed as House Ex. Doc. No. 95, Fifty-second Congress, second session. (See also Appendix U U 8.)

4. Tuolumne River, California.—Maj. Heuer submitted report of examination under date of October 26, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government at the present time. The report was transmitted to Congress and printed as House Ex. Doc. No. 24, Fifty-second Congress, second session. (See also Appendix U U 9.)

5. Stanislaus River, California.—Maj. Heuer submitted report of examination under date of October 26, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the General Government at the present time. The report was transmitted to Congress and printed as House Ex. Doc.

No. 19, Fifty-second Congress, second session. (See also Appendix U U 10.)

6. Mouth of Navarro River, California.—Maj. Heuer submitted report of examination under date of November 4, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not now worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 23, Fifty-second Congress, second session. (See also Appendix U U 11.)

7. Harbor of Crescent City, Cal.—Maj. Heuer submitted report of examination under date of November 5, 1892. He considers the roadstead of Crescent City not worthy of public improvement to the extent of building a breakwater; one improvement which might be made is the removal of Fauntleroy and a few other sunken rocks at and near the entrance of this roadstead, and Maj. Heuer recommends a survey, estimated to cost $1,000, to determine the nature, extent, and cost of such improvement. It is the opinion of the division engineer, concurred in by this office, that the construction of a breakwater at this locality is not worthy of being undertaken by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 29, Fifty-second Congress, second session. (See also Appendix U U 12.)

8. Harbor at Yaquina Bay, Oregon, with a view to obtaining 25 feet of water at mean low water upon the bar at the entrance.—Maj. Heuer submitted report of examination under date of November 3, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the harbor is not worthy of improvement to the extent proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 96, Fifty-second Congress, second session. (See also Appendix U U 13.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN OREGON, WASHINGTON, AND IDAHO.

This district was in the charge of Capt. Thomas W. Symons, Corps of Engineers, with Lieuts. Graham D. Fitch and Francis R. Shunk, Corps of Engineers, under his immediate orders; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. Coquille River, Oregon (general improvement).—Before improvement the entrance to the Coquille River was considered very dangerous. It was by a long, tortuous, and narrow channel, skirting the south headland, and studded with rocks from beyond the bar to a distance of one-half mile inside. The depth at low water was only about 3 feet and the channel was constantly shifting. At long intervals the channel would break through the north spit and run directly out to sea just south of Rackliffe Rock, but never remained long in this position. At such times the entrance was comparatively safe and the channel was at its best. The mean rise of tide was 4.1 feet.

The first plan of improvement was to construct two parallel high-tide stone jetties, 800 feet apart, running out to sea a sufficient distance to open and maintain over the bar a channel with a least depth of 8 feet at low water; the north jetty starting from Rackliffe Rock and the south jetty from a point inside the entrance. Under date of May 8, 1891, the project was changed to provide for an entrance width of 600 instead of 800 feet. The estimated cost of this improvement was $164,200.

The law of August 11, 1888, authorized the expenditure of $5,000 in snagging between Coquille City and Myrtle Point; the law of Septem-

ber 19, 1890, authorized the expenditure, for the same purpose, of a sum not to exceed $3,000.

The cost of completing the work in accordance with the project has recently been reëstimated at $180,000. The amount expended prior to June 30, 1892, was $102,299.98, of which $95,416.08 was expended on the improvement of the mouth and $6,883.90 for snagging.

For considerable periods the channel was kept straight, with a depth on the bar of 8 to 10 feet at low water. At times the winds and currents would heap sand into the channel, causing it to shoal and spread out or break away to the northward, forming a new entrance, shallow and ill directed.

The amount expended during the fiscal year ending June 30, 1893, $16,817.59, was almost entirely consumed in repairing and improving the damage and incomplete work of previous years. The results are practically the same as for the year before.

The appropriations amount to $130,000.

July 1, 1892, balance unexpended	$2,700.02
Amount refunded June 9, 1892	51.52
Amount appropriated by act approved July 13, 1892	25,000.00
	27,751.54
June 30, 1893, amount expended during fiscal year	16,817.59
July 1, 1893, balance unexpended	10,933.95
July 1, 1893, outstanding liabilities	1,850.00
July 1, 1893, balance available	9,083.95
Amount (estimated) required for completion of existing project	150,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895.	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 1.)

2. Coquille River, Oregon, between Coquille City and Myrtle Point.—The Coquille is one of the principal streams of southern Oregon. It is navigated by coasting vessels from its mouth to Coquille City, a distance of 25 miles. This portion of the river has at times been more or less obstructed by snags, but no serious shoals have formed.

From Coquille City to Myrtle Point, a distance of 12 miles, there has always been great trouble in keeping the river open. The drainage area is densely wooded and every freshet brings down many stumps, logs, and trees; these lodge and cause deposits of sediment, forming shoals.

The plan of improvement submitted to comply with provisions of the river and harbor act approved September 19, 1890, is to remove all objectionable snags and to contract the river at certain shoals to a width of 50 feet, in order that the shoals may scour away. The estimated cost was $26,000.

Until the past fiscal year this work had been carried on with certain sums diverted from the appropriation for the mouth of the river. The act of August 11, 1888, authorized the expenditure of $5,000, and the act of September 19, 1890, the expenditure of a sum not to exceed $3,000 in snagging between Coquille City and Myrtle Point. The act of July 13, 1892, made a separate appropriation of $5,000 for this work.

The amount expended during the fiscal year ending June 30, 1893, was $5,000. A great many snags were removed, but, while this was of benefit to navigation, the upper river has been filling up with alluvium, so that its navigable capacity has not increased.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	5,000.00
Amount (estimated) required for completion of existing project	21,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	21,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 2.)

3. Entrance to Coos Bay and Harbor, Oregon.—Before improvement the obstructions at the entrance to this harbor were, first, the sandy, shifting outer bar, and second, the inner sandy shoals, accumulated by the northwest winds of spring, summer, and autumn.

These winds also caused the north spit to extend southward, greatly contracting the navigable channel and making the outer channel follow the west side of the spit in a long and tortuous course across the bar. The channel at times would break through the north spit on a line whose general direction is from Fossil Point to a point just north of Coos Head. It was then direct, its depth greatest, and vessels could pass without trouble. The mean rise of the tide was 5.6 feet.

The project adopted in 1879 was to build, at an estimated cost of $600,000, such a stone and wood jetty as might be found best, from a point 250 yards below the northern extremity of Fossil Point, on a line toward the east end of Coos Head, curving at its outer end so as to be directed a little north of the Head. The object was to prevent extension of the north spit, and to open and maintain a deeper and more direct channel across the bar.

The present project is to build two high-tide stone jetties, one from Coos Head and one from the south end of the north spit, extending out toward the bar and leaving an entrance about 1,500 feet wide. The project also includes the protection of the north spit by plantations, to prevent sand from blowing into the harbor. The estimated cost of these works is $2,466,412.20.

The total expenditure prior to June 30, 1892, was $332,001.91, of which $210,337.74 was upon the old project, $121,664.17 upon the new.

The north jetty had been built to a length of 4,800 feet, of which 1,808 was beyond low-water mark. As a result due to this, and probably to other causes, there was a marked improvement in the entrance channel, the depth being 18 to 21 feet at low water. This exceptional result may be explained by the fact that the jetty cut off a swash channel across the north spit, thus throwing a large additional amount of water into the main channel.

During the fiscal year ending June 30, 1893, the amount expended was $92,780.19. The jetty tramway has been extended to a total length of 8,768 feet, a vast amount of sand has been impounded by the jetty, and a minimum depth of 12 feet at low water has been maintained over the bar.

The appropriations amount to $548,750.

July 1, 1892, balance unexpended		$6,748.09
Amount refunded June 9, 1892		25.86
Amount appropriated by act approved July 13, 1892		210,000.00
		216,773.95
June 30, 1893, amount expended during fiscal year		92,780.19
July 1, 1893, balance unexpended		123,993.76
July 1, 1893, outstanding liabilities	$7,000.00	
July 1, 1893, amount covered by uncompleted contracts	62,401.66	
		69,401.66
July 1, 1893, balance available		54,592.10

Amount (estimated) required for completion of existing project	$2,131,412.20
Amount that can be profitably expended in fiscal year ending June 30, 1895	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 3.)

4. Umpqua River, Oregon.—Just below Scottsburg, the head of navigation on the Umpqua River, are five sandstone ledges 12 to 15 feet wide, and from 1 to 2 feet below low tide at a low river stage. They are separated by pools about 150 feet wide and 5 to 10 feet deep at low water.

The Secretary of War having authorized the expenditure of the balance, $4,685.89, remaining from the appropriation of March 3, 1871, in improving the river below Scottsburg, a project was adopted in 1885 for excavating by blasting a channel 50 feet wide and 3 feet deep at low water through the rock ledges.

In 1890, a survey of the river having been made, a new project was adopted. This provides for the removal of bowlders and ledges in the wharf basin at Scottsburg and below this basin with a view to opening a channel 50 feet wide and 4 feet deep at low water, at an estimated cost of $9,000.

The expenditure prior to June 30, 1892, was $14,245.16. The project was nearly completed; work was interrupted, however, by rising water, and some rocky points requiring removal still remain.

There was no expenditure during the fiscal year ending June 30, 1893.

The appropriations amount to $33,500.

July 1, 1892, balance unexpended	$1,443.28
Amount refunded June 9, 1892	.18
	1,443.46
July 1, 1893, balance unexpended	1,443.46

(See Appendix V V 4.)

5. Mouth of Siuslaw River, Oregon.—The Siuslaw River enters the ocean in the midst of a vast shifting sandy beach, without any headland or fixed point to determine or aid in determining the location of the entrance channel. The unconfined channel has a range of about one mile over which it wanders. The depth on the bar varies from 5 to 12 feet at low water, and the bar channel is very variable in position and direction. At times a channel is developed inside the bar, and running nearly parallel with the coast. This channel is narrow, ill defined, and dangerous, as boats have to pass through it in the trough of the sea. At other times there are two channels.

The plan of improvement is to confine the outgoing and incoming waters between high-tide brush and stone jetties, so located as to direct the currents upon the bar in a direction practically perpendicular to the coast. The north jetty will be 4,500 feet long, the south jetty 3,200 feet, and they are to converge to an entrance 600 feet wide at the crest of the bar.

The amount expended prior to June 30, 1892, was $30,417.86. The work done was of a preliminary character, and there were no results as regards improvement of the entrance. The amount expended during the fiscal year ending June 30, 1893, was $34,625.84.

The work has not progressed sufficiently to produce any results of importance on the bar.

The appropriations amount to $70,000.

July 1, 1892, balance unexpended	$19,581.14
Amount appropriated by act approved July 13, 1892	20,000.00
	39,581.14
June 30, 1893, amount expended during fiscal year	34,625.84
July 1, 1893, balance unexpended	4,955.30
July 1, 1893, outstanding liabilities	1,800.00
July 1, 1893, balance available	3,155.30
Amount (estimated) required for completion of existing project	630,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirments of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 5.)

6. Yaquina Bay, Oregon.—Before improvement the usual low-water depths over the bar at Yaquina Bay were from 7 to 8 feet. There were three distinct channels, known as the North, Middle and South channels. The South Channel was the one mostly used, but was rendered dangerous by rocks. The Middle Channel, though free from rocks, was little used, being usually the shoalest. The North Channel, besides being long and tortuous, was so studded with rocks as to be considered unnavigable. These channels were constantly shifting and changing in depth.

The project adopted in 1881 was to construct a stone jetty on the south side, in order to cause the South Channel to shoal up, and obtain a least high-water depth of 17 feet in the Middle Channel. The jetty was to be 2 feet above mean low water, and was to run out to sea a distance of 2,500 feet from low-water line. The stone was to be deposited from barges, and cribs were to be used if possible. Both were found impossible, owing to roughness of water, and the jetty had to be built from a tramway begun at high-tide level, making the projected length 3,700 feet.

In 1884 the jetty was extended 316 feet shoreward to close a washout, thus making its length about 4,000 feet.

The present project, adopted in 1888, is to raise the south jetty to full high water without further extension, and to build a mid-tide jetty on the north side about 2,300 feet long from the north head to a point opposite the end of the south jetty and about 1,000 feet from it. This project was modified during the past year to the extent of raising the north jetty to full high tide and building five groins from the south jetty towards the channel.

The amount expended up to June 30, 1892, was $535,348.26. The results were highly satisfactory. A low-water depth of 12 to 15 feet was maintained over the bar.

During the fiscal year ending June 30, 1893, $65,501.58 was expended. A minimum bar depth of 14 feet at low water was maintained during the year. A new complication, however, has arisen in the formation of an inner bar 2,000 feet inside the entrance.

The appropriations amount to $635,000.

July 1, 1892, balance unexpended	$14,651.99
Amount refunded	155.18
Amount appropriated by act approved July 13, 1892	85,000.00
	99,807.17
June 30, 1893, amount expended during fiscal year	65,501.58
July 1, 1893, balance unexpended	34,305.59
July 1, 1893, outstanding liabilities	4,800.00
July 1, 1893, balance available	29,505.59

Amount (estimated) required for completion of existing project	$120,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	120,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 6.)

7. Tillamook Bay and Bar, Oregon.—The channel over the bar is direct and shifts but little, so that the bar is considered one of the safest on the Oregon coast. A fair depth of water is maintained throughout the year, so that vessels drawing 13 feet can usually enter.

The bay at low tide consists of three channels of fair depth near the entrance, but shoaling to 1 or 2 feet near the head of the bay. Tillamook City, the principal town of the region, is situated on a tidal slough above the head of the bay, and can be reached only by light-draft vessels at high tide.

No general project for the improvement of the bay and bar has been approved. A special project was approved for the expenditure of the money appropriated by the act of August 11, 1888. This provided for a survey of the bar and entrance, and the construction of longitudinal and spur dikes and shore protection works to deepen the water over Dry Stocking Bar, at the mouth of Hoquarton Slough, and to remove snags and overhanging trees from Hoquarton Slough.

The existing and approved project is to make a navigable pass from the north to the middle channel, so that boats can go to points on the north shore and thence right on up to the head of the bay; to build a dike to deflect the waters from the south to the middle channel at Junction Bar, and to improve Hoquarton Slough by closing up one of the two channels at Dry Stocking Bar. The estimated cost of the work approved is $100,000. The expenditure up to June 30, 1892, was $4,922.95.

No work was done beyond making a survey of the bay and bar. The amount expended during the fiscal year ending June 30, 1893, was $363.34. No work under the project was done and no results obtained.

The appropriations amount to $20,700.

July 1, 1892, balance unexpended		$67.16
Amount appropriated by act approved July 13, 1892		15,000.00
		15,067.16
June 30, 1893, amount expended during fiscal year		363.34
July 1, 1893, balance unexpended		14,703.82
July 1, 1893, outstanding liabilities	$157.00	
July 1, 1893, amount covered by uncompleted contracts	14,546.82	
		14,703.82

Amount (estimated) required for completion of existing project	85,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 7.)

8. Entrance to Nehalem Bay, Oregon.—Nehalem Bay, at high water, is about 2 miles long by 1½ miles wide at the widest part, and is connected with the ocean by a narrow channel extending in a southerly direction about 3 miles. This channel varies in width from 1,000 to 2,000 feet at high tide. It is separated from the ocean by a low, sandy peninsula, about 2½ miles long and one-quarter mile wide. The entrance channel south of this peninsula is shifting, its northern and southern limits being about 1 mile apart. The channel across the bar at the entrance is ordinarily 5 to 6 feet deep.

The plan of improvement is to hold the channel in its southern position by building two high-tide stone jetties; the northern starting from the above-mentioned peninsula and the southern to start from the mainland; these to converge to an entrance width of about 500 feet, and then, if necessary, to run parallel for a sufficient distance to secure a bar depth of 8 feet at low water.

The cost was estimated in 1891 to be $712,338.

The amount expended up to June 30, 1892, was $415.08.

No work was done beyond making a survey.

There was no expenditure during the fiscal year ending June 30, 1893; no results were obtained.

The appropriation is $10,000.

July 1, 1892, balance unexpended	$9,584.92
July 1, 1893, balance unexpended	9,584.92
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	712,388.00

(See Appendix V V 8.)

9. Upper Snake River, Idaho, between Huntington Bridge and Seven Devils mining district.—This portion of the Snake River flows through a deep canyon and is swift, with many rapids and dangerous rocks. The bed and banks are hard basalt and granite. Navigation is almost impossible.

The plan of improvement, submitted in 1891, under provisions of river and harbor act approved September 19, 1890, is to remove rocks and reefs from a channel 150 feet wide and put in ringbolts and iron posts to assist boats in lining up. The estimated cost is $80,000.

The first appropriation for this work, $20,000, was made by act of July 13, 1892.

The amount expended during the fiscal year ending June 30, 1893, was $17,917.71. A large amount of rock was removed from the channel just below Huntington Bridge.

Amount appropriated by act approved July 13, 1892	$20,000.00
June 30, 1893, amount expended during fiscal year	17,998.46
July 1, 1893, balance unexpended	2,001.54
July 1, 1893, outstanding liabilities	25.00
July 1, 1893, balance available	1,976.54
Amount (estimated) required for completion of existing project	60,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 9.)

10. Upper Columbia and Snake rivers, Oregon and Washington.—Under the above head it has been deemed proper to include the continuous Columbia and Snake rivers from Celilo, at the head of The Dalles, to Asotin, Wash.

The Upper Columbia and Snake form a continuous line of navigable river, but broken by many rapids which render navigation difficult and dangerous. These rapids are in nearly every instance caused by rocky bars with occasional bowlders. The channels before improvement were crooked and narrow, the ruling depth at low water over many of the bars was 2 to 3 feet, and some were practicably impassable at low water.

The Columbia was navigable all the year except when closed by ice; the Snake, however, was navigable only during high water, for three or for months in the spring.

Previous to 1877 $20,000 had been appropriated for the work of improvement, and had been expended in surveys and rock removal at the principal rapids.

In 1877 a project was approved which provided for the removal of bowlders and reefs, and for scraping gravel bars in the Columbia and Snake as far as Lewiston. The estimated cost was $132,000.

By the river and harbor act of July 13, 1892, the upper limit of this work was extended from Lewiston, Idaho, to Asotin, Wash., a distance of 7 miles.

The present plan of improvement is to remove bowlders, gravel bars, and rock ledges, and put in such contraction works as may be necessary.

The estimated cost of the work has not been accurately determined because of the lack of continuous and full surveys, and because, from the nature of things, it can not be, as many of the obstructions which it is necessary to remove are continually recurring.

The expenditure prior to June 30, 1892, was $142,717.27. A great deal of rock was removed, with very great benefit to navigation; boats were enabled to carry more than double their previous loads, and with greater safety.

The amount expended during the fiscal year ending June 30, 1893, was $20,248.71.

The worst rocks and reefs between Riparia and Asotin have been effectually cleared out. At two of the worst bars dikes have been partially built, which will soon be completed. They have already had a good effect in deepening the channel.

The aggregate of the appropriations is $271,000.

July 1, 1892, balance unexpended	$8,282.73
Amount refunded December 24, 1892	155.44
Amount appropriated by act approved July 13, 1892	15,000.00
	23,438.17
June 30, 1893, amount expended during fiscal year	20,248.71
July 1, 1893, balance unexpended	3,189.46
July 1, 1893, outstanding liabilities	350.00
July 1, 1893, balance available	2,839.46
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	20,000.00

(See Appendix V V 10.)

11. Columbia River, between head of Rock Island Rapids and foot of Priest Rapids, Washington.—This portion of the Columbia River is about 60 miles long. The banks are precipitous bluffs, from 1,000 to 3,000 feet high. The neighboring country is rocky and sterile. Navigation is obstructed by Rock Island, Cabinet, and Priest rapids.

At Rock Island Rapids the river is divided by a large rocky island. The channel is obstructed by reefs, rocks, sharply projecting points, and extensive gravel deposits, which dam up the water to such an extent that its slope, in escaping, is very steep. The river here, at a stage 4 feet above low water, has a fall of 10 feet in 3,000 feet, and 12½ feet in 8,000 feet.

At Cabinet Rapids a mass of basalt, projecting from the left bank, causes the current to impinge upon the nearly vertical rocks of the

right bank; the channel is also obstructed by masses of rock. The fall here is 10 feet in 8,000 feet.

Priest Rapids include seven principal rapids in about 10 miles. The total fall in this distance is 72 feet at low water; 63½ feet at high water. At all these rapids the banks and bottom are of hard and jagged basalt.

The project under which the work of improvement has been done was approved October 18, 1890. It consists in removing rocks at the three rapids, and putting in iron posts and ringbolts to enable steamers to line up. The estimated cost of this work was $550,000. In addition, a survey was to be made from Rock Island Rapids to the Canadian boundary.

Up to June 30, 1892, the amount expended on the improvement was $49,566.56; on the survey, $9,919.86. The worst obstructions were removed from the channel at the three rapids, and a number of posts and ringbolts put in. The results would have rendered navigation safer had there been any navigation.

During the fiscal year ending June 30, 1893, the amount expended was $2,302.66, of which $80.14 was for the survey, which was completed from the boundary line to the mouth of the Okanogan River.

July 1, 1892, balance unexpended	$10,513.58
June 30, 1893, amount expended during fiscal year	2,302.66
July 1, 1893, balance unexpended	8,210.92

(See Appendix V V 11.)

Survey of Columbia River from the international boundary line to Rock Island Rapids, Washington.—The river and harbor act approved September 19, 1890, allotted $10,000 for a survey of the Columbia River from the international boundary to Rock Island Rapids. With this amount the survey has been completed from the boundary down to the mouth of Okanogan River, 214 miles; and no further provision having been made for completion of the survey to Rock Island Rapids, Capt. Symons submitted report, dated March 15, 1893, upon the reach of 214 miles surveyed. The report is submitted herewith with Appendix V V 11.

The territory tributary to this portion of the river is as yet largely undeveloped; and the only portion of it now navigated by steamers is the stretch of 13 miles below the boundary line. The obstructions to navigation, consisting of rocks, rapids, falls, and a generally swift current, can in some places be overcome by removal of rock and clearing channels; other places, incapable of any system of regularization, can be rendered passable only by the construction of canals, locks, and dams, boat railways, hydraulic lifts, or other suitable contrivances for passing boats from one level to another. The cost of providing a good commercial through navigation from the boundary to the Okanogan is estimated as follows:

Removal of rock at various localities	$275,000
Dam and locks at Little Dalles (15 miles from boundary)	1,500,000
Dam and locks at Kettle Falls (41 miles from boundary)	1,250,000
Dam and locks at Grand Rapids (48 miles from boundary)	1,500,000
Two dams and locks below month of Spokane River (105 miles from boundary)	3,000,000
Seven dams and locks in reach of 42 miles from Monaghan Rapids to Foster Creek Rapids (161–203 miles from boundary)	10,500,000
Total	18,025,000

An estimate of the cost of a less radical improvement of the 42 miles from Monaghan Rapids to Foster Creek Rapids, amounting to $980,000, is also presented by Capt. Symons.

A report upon a preliminary examination of the Columbia River between the international boundary and Rock Island Rapids, made by Capt. Symons, October 12, 1892, is submitted herewith as Appendix V V 24, in connection with which the views of the Engineer Department as to the expediency of improving this locality are expressed. (See p. 445.)

12. Nasel River, Washington.—In its original condition the Nasel River had enough water for navigation, but had become badly obstructed by snags.

The plan of the improvement, submitted in 1891 under the provisions of the river and harbor act approved September 19, 1890, was to remove the snags obstructing navigation, at an estimated cost of $1,500. This amount was appropriated by the act of July 13, 1892; and, by its expenditure during the past fiscal year the river was cleared of all objectionable snags.

Amount appropriated by act approved July 13, 1892	$1,500.00
June 30, 1893, amount expended during fiscal year	1,500.00

(See Appendix V V 12.)

13. Willapa River and Harbor, Washington.—Willapa Harbor, formerly known as Shoalwater Bay, is an inlet of the Pacific Ocean 28 miles north of the mouth of the Columbia. The principal town on the harbor is South Bend, the terminus of a branch line of the Northern Pacific Railroad, situated near the mouth of the Willapa River. At the upper end of the town the river divides into a main channel and a secondary channel, known as Mailboat Slough; these reunite at the lower end of the town. Bars had formed in the main channel at both ends of the slough. There were also several bars in the Willapa River, between South Bend and Willapa City.

The plan of improvement, submitted in 1891 to comply with requirements of river and harbor act approved September 19, 1890, proposed to close the head of Mailboat Slough with pile, brush, and stone dikes, thereby throwing all the water into the main channel and scouring away the shoals; to dredge a channel 100 feet wide and 8 feet deep at low water through the shoal just below Willapa City; and to close Louderback Slough with a pile, brush, and stone dike, in order to compel the currents to scour a channel through the bar above the river mouth. The estimated cost was $31,350.

The first appropriation for this work, $18,000, was made by the act of July 13, 1892.

The expenditure during the fiscal year ending June 30, 1893, was $11,658.72. Of this amount, $6,818.73 was expended on the Mailboat Slough dikes and $5,339.99 in dredging the shoal below Willapa City. About one-third of the dredging has been done.

The Mailboat Slough dikes were completed, and have already caused some deepening and marked widening of the channel over the bar at the lower end of the slough.

Amount appropriated by act approved July 13, 1892		$18,000.00
June 30, 1893, amount expended during fiscal year		11,658.72
July 1, 1893, balance unexpended		6,341.28
July 1, 1893, outstanding liabilities	$90.00	
July 1, 1893, amount covered by uncompleted contracts	6,251.28	
		6,341.28

Amount (estimated) required for completion of existing project	$13,350.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	13,350.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 13.)

14. Grays Harbor and Chehalis River, Washington.—The Chehalis River is the principal tributary of Grays Harbor. From Montesano to the bay there is usually enough water for coasting vessels, but there are four shoals. At the head of Grays Harbor the waters divide into a north and south channel. There is also a middle channel connecting the other two. These divisions cause objectionable shoals.

The plan of improvement, submitted in 1891 to comply with requirements of the river and harbor act approved September 19, 1890, is to remove the shoals from the river by dredging and closing side sloughs and channels, so as to give a depth of 16 feet at half tide; to build dikes of pile, brush, and stone in the harbor, wholly closing the middle channel, and closing the south channel, with the exception of a gap 1,000 feet wide and about 8 feet deep, with a view to increasing the tidal flow through the north channel and scouring away the bars. The estimated cost was $150,000.

The first appropriation for the work, $50,000, was made by act of July 13, 1892.

The amount expended during the fiscal year ending June 30, 1893, was $5,672.97. The works were but fairly started, and have not as yet had any appreciable effect.

Amount appropriated by act approved July 13, 1892		$50,000.00
June 30, 1893, amount expended during fiscal year		5,672.97
July 1, 1893, balance unexpended		44,327.03
July 1, 1893, outstanding liabilities	$160.00	
July 1, 1893, amount covered by uncompleted contract	44,167.03	
		44,327.03

Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 14.)

15. Chehalis River, Washington.—The possibly navigable portion of the Chehalis River is from Claquato to the mouth, a distance of 90 miles. This may well be considered in three sections.

1. From the mouth to Montesano, a distance of 15 miles, there is a depth of 18 feet at high water. This portion is navigable for coasting vessels.

2. From Montesano to Elma, 16 miles, the river is slightly affected by the tides, and for the most part has enough water for light-draft boats, but it is obstructed by snags and fallen trees, and in summer there is a scarcity of water on the bars.

3. Above Elma the river is practically blockaded during the summer and autumn by snags and a general lack of water; it becomes a succession of pools and shoals; on many of the latter the depth is from 6 to 12 inches only.

The plan of improvement is to remove snags, overhanging trees, jams, drift heaps, shoals, and other obstructions to navigation.

The amount expended to June 30, 1892, was $10,715.48. The river from Montesano to the mouth was kept open and free from obstructions.

The amount expended during the fiscal year ending June 30, 1893, was $133.15. No work was done beyond an examination of the river, which showed that there were no objectionable snags.

The appropriations amount to $13,000.

July 1, 1892, balance unexpended	$2,284.72
June 30, 1893, amount expended during fiscal year	133.15
July 1, 1893, balance unexpended	2,151.57

(See Appendix V V 15.)

16. Harbor at Olympia, Wash.—Olympia is situated at the head of Budds Inlet, which is badly shoaled up for a distance of 8,750 feet from the city. Vessels can reach the city at high tide only; to avoid this inconvenience, long wharves have been built, whose maintenance, owing to the teredo, is very expensive.

It is proposed by the project submitted in 1891, under provisions of river and harbor act approved September 19, 1890, to dredge a channel 250 feet wide and 12 feet deep at mean lower low water, from the heart of the city, at the Fourth Street Bridge, to deep water in Budds Inlet, at an estimated cost of $275,000.

The first appropriation for the work, $35,000, was made by act of July 13, 1892. With the money now available, it is proposed to excavate a channel 125 feet wide and 6 feet deep at lower low water.

The amount expended during the fiscal year ending June 30, 1893, was $2,313.26. The excavation of the reduced channel is well under way.

Amount appropriated by act approved July 13, 1892		$35,000.00
June 30, 1893, amount expended during fiscal year		2,313.26
July 1, 1893, balance unexpended		32,686.74
July 1, 1893, outstanding liabilities	$150.00	
July 1, 1893, amount covered by uncompleted contracts	32,536.74	
		32,686.74

Amount (estimated) required for completion of existing project	240,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	150,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix V V 16.)

17. Swinomish Slough, Washington.—This is a tidal slough, connecting Saratoga Passage and Skagit Bay on the south, with Padilla Bay on the north. It is an important highway for the smaller class of steamboats. In some parts, however, it is shallow and crooked, and the approaches to it are across shallow flats.

The plan of improvement, submitted in 1891 under provisions of the river and harbor act approved September 19, 1890, is to dredge a channel 100 feet wide and 4 feet deep, from deep water in Saratoga Passage, across the Skagit Flats, through the shoals in Swinomish Slough, and across the flats in Padilla Bay to deep water; and to build wattled pile-dikes in Skagit and Padilla bays, to direct the tidal currents through the dredged channels. The estimated cost was $122,000.

The first appropriation for the work, $25,000, was made by act of July 13, 1892.

The amount expended during the fiscal year ending June 30, 1893, was $393.98. No work beyond a preliminary survey was done.

Amount appropriated by act approved July 13, 1892		$25,000.00
June 30, 1893, amount expended during fiscal year		393.98
July 1, 1893, balance unexpended		24,606.02
July 1, 1893, outstanding liabilities	$735.00	
July 1, 1893, amount covered by uncompleted contracts	23,871.02	
		24,606.02

Amount (estimated) required for completion of existing project	97,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	97,000.00

(See Appendix V V 17.)

18. Puget Sound and its tributary waters, Washington.—This work was formerly known as the "Improvement of Skagit, Stillaguamish, Nooksack, Snohomish, and Snoqualmie rivers, Washington."

In their original condition, these rivers carried water enough for steamer navigation, but were obstructed by snags, fallen trees, and log jams. They were the chief highways of the country. About their mouths were large areas of shallow water with tortuous channels, often obstructed by drift.

The plan of improvement contemplates the removal of snags, logs, trees, and other obstructions to navigation. For this purpose a snag boat with complete outfit has been provided. This boat goes from one river to another as necessity requires.

The amount expended prior to June 30, 1892, was $67,495.58. No permanent results were aimed at or obtained. The constantly recurring obstructions require to be periodically removed. The rivers were kept open and navigation rendered much safer.

The amount expended during the fiscal year ending June 30, 1893, was $7,998.28. A great number of obstructions were removed, and navigation was thereby greatly benefited.

July 1, 1892, balance unexpended		$2,004.42
Amount appropriated by act approved July 13, 1892		15,000.00
		17,004.42
June 30, 1893, amount expended during fiscal year		7,998.28
July 1, 1893, balance unexpended		9,006.14
July 1, 1893, outstanding liabilities		200.00
July 1, 1893, balance available		8,806.14

Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	25,000.00

(See Appendix V V 18.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Capt. Thomas W. Symons, Corps of Engineers, and reports thereon submitted through the division engineer, Col. G. H. Mendell, Corps of Engineers.

1. Chetco River, Oregon.—Capt. Symons submitted report of examination under date of September 16, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States. The report was

transmitted to Congress and printed as House Ex. Doc. No. 92, Fifty-second Congress, second session. (See also Appendix V V 19.)

2. Rogue River, Oregon, from Grants Pass to the mouth.—Capt. Symons submitted report of examination under date of October 10, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 51, Fifty-second Congress, second session. (See also Appendix V V 20.)

3. Navigable tide-water channels of Coos River, Oregon, with a view to remove snags, logs, and other obstructions.—Capt. Symons submitted report of examination under date of October 17, 1892. He considers that these navigable channels are worthy of improvement by the General Government to the extent of removing the existing obstructions; a survey is not deemed necessary, as conditions are constantly changing and sufficient information is at hand for the preparation of an estimate of the cost of improvement. It is the opinion of the division engineer, concurred in by this office, that the improvement is worthy of being made to the extent of removing the snags and bowlders mentioned. The report was transmitted to Congress and printed as House Ex. Doc. No. 42, Fifty-second Congress, second session. (See also Appendix V V 21.)

4. Inner navigation of Alsea River, Oregon.—Capt. Symons submitted report of examination under date of October 10, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is worthy of improvement by the United States. The cost of a survey necessary for preparation of project and estimate of cost of improvement is estimated at $1,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 53, Fifty-second Congress, second session. (See also Appendix V V 22.)

5. Nestugga River, Oregon, as far as Woods.—Capt. Symons submitted report of examination under date of October 10, 1892. He considers the river worthy of improvement to the extent of removing the dangerous reef of rocks extending from the headland at the south of the harbor throat about 100 feet directly into the channel. It is, however, the opinion of the division engineer, concurred in by this office, that Nestugga River, as far as Woods, is not worthy of improvement by the General Government. The report was transmitted to Congress and printed as House Ex. Doc. No. 97, Fifty-second Congress, second session. (See also Appendix V V 23.)

6. Upper Columbia River, Washington, from the international boundary to Rock Island Rapids.—Capt. Symons submitted report of examination under date of October 12, 1892. It is his opinion and that of the division engineer, concurred in by this office, that there are two portions of the river within the limits named that are worthy of improvement by the General Government—one from Little Dalles to the international boundary line, a distance of 15 miles, and the other from the head of Rock Island Rapids to Foster Creek Rapids, just above the mouth of the Okanogan, a distance of 90 miles. Capt. Symons estimates the cost of a survey necessary for preparation of project and estimate of cost of improvement of the latter section at $4,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 39, Fifty-second Congress, second session. (See also Appendix V V 24.)

A report upon a survey of Columbia River from the international boundary to the mouth of Okanogan River, under provisions of act

of September 19, 1890, was made by Capt. Symons March 15, 1893. (See p. 440.)

7. Kootenai River from Fry, Idaho, to international boundary line.—Capt. Symons submitted report of examination under date of October 12, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is worthy of improvement by the General Government. Capt. Symons estimates the cost of a survey to determine accurately the number of snags to be removed at $400; but he states that as new snags are constantly coming in and old ones are occasionally carried away, such a survey would not necessarily give a correct idea of the work necessary at any time in the future. The report was transmitted to Congress and printed as House Ex. Doc. No. 93, Fifty-second Congress, second session. (See also Appendix V V 25.)

8. Spokane River, Idaho, from Post Falls to Lake Cœur d'Alene.—Capt. Symons submitted report of examination under date of September 7, 1892. He considers this section of the river worthy of improvement, to the extent of providing an all-the-year navigation for boats drawing 3 feet of water, provided a careful survey, which is estimated to cost $600, shows that the improvement can be made at moderate cost and without seriously interfering with vested interests. The division engineer considers the locality worthy of improvement to the extent of a survey, which shall determine whether or not it shall be practicable and expedient to make the river navigable by a dam at Post Falls. In the judgment of this office the locality is not at present worthy of improvement by the United States. The report was transmitted to Congress and printed as House Ex. Doc. No. 79, Fifty-second Congress, second session. (See also Appendix V V 26.)

9. Snohomish River, Washington, from its mouth to Lowell.—Capt. Symons submitted report of examination under date of October 14, 1892. He considers that the "Old River," one of the sloughs forming the outlets of Snohomish River, is worthy of improvement by the United States to the extent of removing all snags, piles, dolphins, etc., obstructing navigation. A survey to determine the amount of work to be done would cost $250, but such a survey seems scarcely necessary; it is difficult to make a close estimate of the cost of such work, and a general estimate can be made as well without the survey as with it. If this improvement could be provided for under the appropriation for improving Puget Sound and its tributary waters, the work could be done with the Government snag boat *Skagit*, which is used in clearing the various navigable rivers entering Puget Sound.

The division engineer considers that the river is worthy of improvement to the extent of removing the obstructions that could be handled by the *Skagit*. The views of these officers are concurred in by this office. The report was transmitted to Congress and printed as House Ex. Doc. No. 103, Fifty-second Congress, second session. (See also Appendix V V 27.)

10. Everett Harbor, Washington, including mouth of Snohomish River.—Capt. Symons submitted report of examination under date of October 12, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the locality is not worthy of improvement by the General Government. The report was transmitted to Congress, and printed as House Ex. Doc. No. 47, Fifty-second Congress, second session. (See also Appendix V V 28.)

11. Nooksack River, Washington, with a view of removing obstructions, straightening channel to prevent jams and the filling of Bellingham Bay

with deposits of earth.—Capt. Symons submitted report of examination under date of October 13, 1892. He states that all requisite work for the removal of obstructions and straightening of channel to prevent jams in Nooksack River can be properly provided for under the regular appropriations for improving Puget Sound and its tributary waters; and he considers that work to prevent the filling of Bellingham Bay by detritus brought down the Nooksack is an improvement worthy of being undertaken by the United States. It is the opinion of the division engineer, concurred in by this office, that Nooksack River is worthy of improvement by the General Government to prevent shoaling in Bellingham Bay. The cost of a survey necessary for preparation of project and estimate of cost of the work is estimated at $1,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 32, Fifty-second Congress, second session. (See also Appendix V V 29.)

IMPROVEMENT OF WILLAMETTE AND LOWER COLUMBIA RIVERS AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

This district was in the charge of Maj. Thos. H. Handbury, Corps of Engineers, with Lieut. Harry Taylor, Corps of Engineers, under his immediate orders; Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. Mouth of Columbia River, Oregon and Washington.—The project under which this work is being carried on was adopted in 1884, and slightly modified in regard to the manner of completing it in 1893. It contemplates providing and maintaining a navigable channel across the Columbia River Bar having a depth of 30 feet at low tide. This is to be accomplished by directing the water which flows over the sand spit at the south of the entrance so that it will be concentrated upon the bar where the resultant currents may scour away the sands and produce the desired depth of channel. The work now in process of construction, by which this result is to be accomplished, consists of a high-tide jetty which starts from the shore near Fort Stevens, on the South Cape, and extends in a westerly direction, with a slight curve to the south, out across Clatsop Spit for a distance of 4¼ miles to a point about 3 miles south of Cape Disappointment. The jetty is constructed of rock, resting upon mattresses 40 feet wide and from 2½ to 5 feet thick, laid upon the sand. When finished the level of the top of the jetty at the shore end will be 12 feet above the mean low-water plane; from thence, for a distance of about 2 miles, it slopes to a height of 10 feet, and from thence to the end to a height of 4 feet. There will be 4 low-tide groins on the north side of the jetty, two of which will be 1,000 feet each in length, one 600, and the other 500 feet.

The material thus far has been placed in position from a jetty tramway upon piles driven along the line of the jetty, and about 24 feet above the level of low tide. The tramway is a double track 3-foot gauge railroad, the tracks being 13 feet between centers and 28 feet above the plane of mean low water. The material is landed at the wharf from barges and transported to place over these tracks, which are built in advance of the main work.

Before the commencement of this work the channel or channels over this bar were very capricious in location and variable in depth. The depths were usually from 19 to 21 feet, and the channels varied in number from 1 to 3 and in location through nearly 180° from Cape Disappointment to Point Adams.

In the last annual report it was mentioned that the jetty tramway had reached the outer limit to which it was proposed to extend the jetty, 4¼ miles from the shore end at station 25+80, and that the jetty was being constructed by throwing in rock throughout this whole distance. This process has been continued during the present year. The results thus far obtained are very marked in the manner in which it has caused Clatsop Spit to be raised out of the water, checked the flow over that spit, and concentrated the scouring effect upon the bar.

Soundings made during the latter part of June, for the purpose of developing the deepest water over the bar, show a decided improvement since my last annual report. The 30-foot curves on the outside and inside of the bar on the north side of the channel are fully three-quarters of a mile nearer to each other than they were at that time, and at two points these curves have come together, giving depths of 30 feet over the bar at low water. The width of the 27-foot channel is now about three-quarters of a mile, and the 25-foot channel about one mile and a half. The strong southerly winds, and at many times storms, which prevailed during last winter and spring have kept the sands banked up against the mouth of the river more than would otherwise have been the case and made more work for the ebb currents to keep the channel clear.

The principal work during the year has been receiving rock from the contractors, transporting this and placing it upon the jetty, and keeping the plant in good serviceable condition.

Under the contract dated January 22, 1891, in force at the beginning of the fiscal year, 97,052 tons of rock was received. In addition to this 263 tons was purchased in open market at the contract rate. The last delivery of rock received was made February 10, 1893.

On the 15th of February, 1893, the proposals received, after advertisement, for delivery on board barges of 100,000 tons of rock, with the privilege of doubling this quantity, were opened. A contract was entered into for the delivery of this quantity of rock on board barges at Hinkle's Quarry, about 15 miles above Vancouver, on the Columbia River, for 63½ cents per ton of 2,000 pounds. The first delivery under this contract was made March 29. From that date to the end of the fiscal year 34,292.5 tons was received, making a total of 131,608 tons received during the year. The total received from all sources since the commencement of the work is 610,498 tons.

The top of the jetty for the first two miles will average about the mean high-water line; for the remainder of the distance the average will be about 4 feet above the mean low-water line.

The delivery of rock was suspended from the end of January to the end of March. Opportunity was taken of this interval of suspension to renew the stringers and caps in portions of the tramway that had decayed to such an extent as to be dangerous to move trains over, and also to make general repairs that were much needed to the barges, towboats, and rolling stock of the plant.

A board of engineer officers was convened for the purpose of considering the results obtained and data collected during the construction of this work and reporting upon the matter of its completion, with an estimate of cost. The board rendered its report under date of May 27, 1893, and recommended that when considered as completed the top at the shore end, station 25+30, should be at reference 12 above datum plane, and should slope thence to reference 10 out to station 122+00 (1.8 miles); thence to reference 4 at the outer end; the rock necessary to raise the jetty to this height to be dumped upon the present pile,

letting it take what slope it will in cross section under the action of the waves.

To give greater permanence to the sand and to increase the quantity that may accumulate in the vicinity of the north side of the jetty, which would seem to be the direction from which danger is most likely to come, the board recommends that four low groins be built out from the main jetty.

Assuming the condition of the jetty as it was March 1, 1893, the board's estimate for completion, in accordance with its recommendations, was $583,203.50. The recommendation and estimate of the board have been approved.

The estimate of the cost of this improvement, submitted with the project of the board of 1882, was $3,710,000. To March 1, 1893, there had been appropriated for the work $1,687,500. The balance then available for its further prosecution was $245,024.11. For the entire completion of the work in accordance with the project now recommended an additional appropriation of $338,180 will be required. It is scarcely necessary to call attention to the fact that under existing circumstances the completion of this work cannot be long delayed without great risk of largely increasing the cost. It is, therefore, advisable that this amount be made available at as early a day as practicable.

July 1, 1892, balance unexpended	$53,796.77
Amount appropriated by act approved July 13, 1892	350,000.00
	403,796.77
June 30, 1893, amount expended during fiscal year	214,985.79
July 1, 1893, balance unexpended	188,810.98
July 1, 1893, amount covered by uncompleted contracts	41,724.29
July 1, 1893, balance available	147,086.69
Amount (estimated) required for completion of existing project	338,180.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	338,180.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W W 1.)

2. Columbia River between Vancouver, Wash., and mouth of Willamette River.—The project for this improvement, as set forth in House Ex. Doc. No. 36, Fifty-second Congress, first session, was submitted to comply with provisions of the river and harbor act approved September 19, 1890. It consists in closing the chute behind Hayden Island, opposite Vancouver, by a dam 4 feet in height above low water, and throwing all the water which passed down this chute at this stage into the main channel between the island and Vancouver. About 36 per cent of the low-water discharge of the river passed behind this island. The difficulty to navigation that it is expected will be removed by this work is a sand bar located between the mouth of the Willamette River and Vancouver on which at low water there is but 9 feet. Were this removed vessels drawing 20 feet or more could easliy ascend above Vancouver. The increased current due to this addition of water in the main channel is expected to produce deeper water on this bar and eventually remove it. The dam is built of piles, brush, and rock, and when finished will have a width of 6 feet at the top and a base of from 25 to 30 feet in width in the deepest water. The shore ends are protected for a distance of 250 feet along the banks by brush mattresses covered with rock. The length of the dam is 2,900 feet. At the end of March, when the work was nearly completed, it was necessary

to suspend the delivery of materials on account of high water in the river. This stage continued to the end of the year. The results produced by the dam and the effect of high water upon it can not be ascertained until the water subsides.

The total amount of the estimate for this work, $33,000, was appropriated by the river and harbor act of 1892. Proposals for furnishing the material in place necessary for this dam were advertised for and a contract entered into September 29, 1892, with Messrs. Borthwick & Davison, the lowest bidders. The contract should have been completed January 6, 1893. The work was commenced October 14, 1892, but by reason of a want of proper energy and management on the part of the contractors it was not completed when the summer rise in the Columbia River began in April and material could not be received. In consequence of this the dam, although nearly completed, can not be finished until the water subsides.

It is believed that the balance on hand at the end of the present fiscal year will be sufficient for the completion of the work.

Amount appropriated by act approved July 13, 1892	$33,000.00
June 30, 1893, amount expended during fiscal year	24,905.76
July 1, 1893, balance unexpended	8,094.24
July 1, 1893, amount covered by uncompleted contracts	6,000.00
July 1, 1893, balance available	2,094.24

(See Appendix W W 2.)

3. Canal at the Cascades, Columbia River, Oregon.—The general scope of the improvement which it is desired to effect at the Cascades of the Columbia River includes a reach of about 4½ miles, where the river rushes through a narrow gorge in the Cascade Mountains. The fall in the distance is about 45 feet at high water and 36 feet at low water. The principal obstruction to navigation occurs at the upper end of the reach known as Upper Cascades. The project for the improvement contemplates that the river should be improved below the Upper Cascades by removing bowlders and projecting points in the bed and banks so as to give good navigable water from its lowest up to a 20-foot stage. The fall at the Upper Cascades is to be overcome by digging a canal of 3,000 feet in length across the neck of a low projecting spur, around which the river is forced at the entrance to the gorge, and placing in this a lock and other suitable structures, which would permit of the passage of boats up to a 20-foot stage of water in the river, this lock and canal to be so arranged that, should the future necessities of commerce so demand, additional structures may be added which will permit of navigation at much higher stages.

The first part of this project, that of improving the river below the foot of the Upper Cascades, is practically finished.

The difference of level between the head and foot of the canal as now established is 15 feet at high water and 24 feet at low water, and difference in height between high and low water at the foot is 54 feet and at the head 45 feet.

At the commencement of the present fiscal year there was a balance of $17,833.60 available for the prosecution of the work. At that time the high water of the Columbia River filled the lock pit and no field work other than stonecutting was in progress. At the end of July all active operations were suspended. The office force was engaged during the year in making detailed drawings of the work still to be done, in order to complete the improvement according to the present project.

During the month of March some bowlders that were in the way of boats running to the lower entrance to the lock at low water were removed by blasting.

During the year 5,236 cubic feet dimension basalt and 1,659 cubic feet of face basalt stone were cut.

To comply with the provisions of the river and harbor act approved July 13, 1892, respecting this work, specifications were prepared and proposals invited for completing it according to the present project. The proposals received after sixty days' advertisement were opened November 15, 1892. The proposal of J. G. & I. N. Day, San Francisco, Cal., being the lowest, a contract was entered into with this firm under date of December 27, 1892; and such portions of the Government plant as they might require for the prosecution of their work were turned over to them on the 10th day of February.

By the terms of the contract "the work must be commenced within ten days from the date of notification of the approval of the contract, and must be so conducted that the contractor may earn, in carrying out the work prescribed by the engineer officer in charge, each of the amounts (after deducting the estimated amounts necessary for all contingencies of engineering superintendence, etc.) that may be appropriated for this work within one year from the date of approval of contract, or within one year from the date of the act appropriating each amount;" estimates for payment, to be made monthly, to include the excavated material removed and the material delivered in place during the preceding month.

The act approved March 3, 1893, making appropriations for sundry civil purposes contains an item of $1,239,653 applicable to this work.

The contractors were duly notified of the order of the work to be done and paid for with these amounts.

At the time the contractors took charge of the plant the ground was covered with snow to a depth of six feet or more, making active outdoor work at that time impossible. The whole of the months of February and March were very unfavorable for work and the month of April was also unfavorable. By the end of June the contractors had made preparations for bringing rock to the Government grounds as rapidly as they will probably be able to get stonecutters to cut it. They obtain their stone, which is an excellent quality of basalt bowlders, from a point about 3 miles east of the Government stone yard. This they reach by running two miles on the Union Pacific tracks and one mile on a spur of their own. They began preliminary work in the quarry during the latter part of March, began quarrying April 17, and brought the first stone to the yard on the 30th of May. Stonecutting was commenced June 6 and from that date to the end of the month the average was 31 cutters per day. The quantity of granite and basalt to be cut will furnish employment for 150 cutters for eight months. The granite required in the work is being quarried and cut near Raymond, Fresno County, Cal.

At the end of the year the orders for the metal work, the estimated weight of which is over 1,600 tons, that will be required in the construction of the locks had not been placed by the contractors.

They have received at the works 2,850 barrels of cement which the tests show to be of excellent quality, and have other cargoes en route, that are expected to arrive by the time that the cement will be required for use this fall. About 46,000 barrels will be required for the work.

It is evident that the contractors will have to increase their force largely and push their work much more rapidly than they have been

doing up to this time in order to complete it within the time required by the specifications. No material can be put in place by the contractors until after the water has fallen below the lower bulkhead and the lock pit can be pumped out, which will probably not take place this year until the middle or latter part of August.

The State Portage Railroad continued in operation across the Government grounds during such portions of the year as the connecting boats, one above the Cascades and one below, were not laid up on account of ice or high water. The boats began to run July 30 and continued until December 17, when they suspended until March 1 on account of ice. They resumed again at that time and continued until one laid up for repairs, May 15. At that time the water below the lock was 31.5 feet above low water. On June 30 this boat, which is provided with only moderate power, commenced her regular trips again on a 36-foot stage of water.

It is now fully demonstrated that boats of reasonable power will have no difficulty in ascending the rapids to the locks at all ordinary high-water stages.

During the year there were 5,553 passengers and 7,800 tons of freight transported by these two boats. This comprehends all the river tonnage of the Middle Columbia between The Dalles and Cascade locks.

The amount expended upon this work to June 30, 1893, is $1,875,581.80. The balance unexpended on that date is $1,564,338.33, which, so far as can now be ascertained, is believed to be sufficient to complete the work according to the present project.

July 1, 1892, balance unexpended	$17,833.60
Amount appropriated by act approved July 13, 1892	326,250.00
Amount appropriated by sundry civil act approved March 3, 1893	1,239,653.00
	1,583,736.60
June 30, 1893, amount expended during fiscal year	19,398.27
July 1, 1893, balance unexpended	1,564,338.33
July 1, 1893, amount covered by uncompleted contracts	1,521,265.00
July 1, 1893, balance available	43,073.33

(See Appendix W W 3.)

4. Columbia and Lower Willamette rivers below Portland, Oregon.—The object of this improvement now is to make and maintain a navigable channel from the city of Portland, Oregon, to the sea, having a low-water depth of 25 feet. There is included in this reach 12 miles of the Willamette River and 98 miles of the Columbia, measured along the deep-water channel. Before the commencement of the improvement made under previous projects, the low-water depth of channel at the shoalest places was between 10 and 15 feet. At the end of the last low-water season there was a depth of 20 feet throughout the entire distance, except at two points in the lower reach of the Columbia. The depth here was 19 feet, with an average rise of tide of 7 feet in the locality.

The original project under which this improvement has been carried on, with modifications and extensions, was adopted in 1877. Some dredging work had been done previous to that time. It contemplated that a navigable low-water channel having a depth of 20 feet should be maintained by means of permanent construction to protect the banks, contract the rivers in wide places, direct the currents, and control the amount of water that should pass through sloughs having a detrimental influence upon the main channel. While these constructions were be-

ing put in place, and until their influence was fully developed, dredging was resorted to in several localities to give a temporary relief to commerce. Works of a permanent character have been erected in the Willamette River across the head of Swan Island Chute, at the head of Willamette Slough, to control the amount of water passing into that channel; also along the left bank of the river from that point to its mouth, to prevent erosion and excessive widening of the river; also across other sloughs and channels near the mouth of the Willamette River, to control its waters and those of the Columbia in that vicinity. Permanent structures were placed in the Columbia River at St. Helens, Burke Slough, and Martin Slough.

The project was extended in 1891 with the view to obtaining by the same methods a low-water channel having a depth of 25 feet. Under this modification the contraction works have been placed in the Willamette River at St. John and Post-Office Bar and in the Columbia River at Walker Island and Cathlamet Bay at the expense of the port of Portland. Similiar works have been placed in the Columbia River at Martin Island Bar, and additions have been made to the works at St. Helens Bar at the expense of the United States. All these contraction works have produced and continue to produce very beneficial effect upon the navigable channels in their vicinity.

The amount expended by the United States on this since the adoption of the project, July 1, 1877, is $775,138.58. It appears that previous to that date $221,780.46 had been expended in various operations looking to the improvement of these rivers between Portland and the sea. The aggregate of the appropriations and allotments, including proceeds from sales of property to other appropriations up to June 30, 1893, is $1,039,745.71. The citizens of Portland, prior to the adoption of the project for obtaining the 25-foot channel, had from time to time expended considerable sums in assisting to keep open a deep channel to the sea. The aggregate of these amounts can not now be ascertained.

The amount available for the work at the end of the present fiscal year is $42,827.42.

The season for active field operations commenced this year about the first of September. During the first ten days in December a snag boat worked on the Lower Willemette and Columbia rivers, removing 29 snags from the channel. On the 7th of September the Government dipper dredge resumed operations upon Swan Island Bar, in the city of Portland, and was kept in commission until the end of March. At this time the Willamette had risen to a 6-foot stage, which made the water at the point where the dredging was done 28 feet deep, which is the limit at which the dredge could work. Operations were then suspended for the season.

The season proved to be very unfavorable for dredging. There were 176 working days of eight hours each within the time that the dredge was in commission. Of this number, the equivalent of 78½ days was lost through high water, bad weather, delays on account of repairs to breakages, and removals from channel to allow vessels to pass.

The work of the dredge was confined to widening the old channel that has been dredged and redredged through Swan Island Bar. The dredging heretofore has been confined to a width of 100 feet and a low-water depth of 20 feet. The work this season consisted in widening this cut to 150 feet and digging the widened portion to a depth of 22 feet. There was removed during the season 45,887 cubic yards of material, the greater portion of which was towed in the dump scows 3 miles down the river and deposited behind the dike above St. Johns.

About one more month's work with the dredges would have put this locality in very good condition for passing vessels of any draft that will probably enter this port. To afford greater accomodations for vessels loading and anchoring in this part of the harbor, the dredging should be extended on both sides to the established harbor lines. It is expected, however, that the contraction of the water caused by the construction of the dam across the chute behind Swan Island, and the building of docks in this vicinity out to the harbor lines will not only keep the dredged cut open, but gradually enlarge it.

The total expense of the dredging operations, including all repairs to the dredge, the tender, and the dump scows, and all other expenses, excepting the cost of two new dump scows, which was $3,600, was $15,897.54. It should be stated that this amount includes extraordinary repairs to the amount of $4,550 to the dredge and dump scows, which had been lying idle for a long time.

The dike at Martin Island Bar, Columbia River, 2,500 feet in length, which is called for by the present project for this improvement, was built by contract for the material delivered in place at a cost of $20,335.11.

The lower 1,600 feet of the dike, at St. Helens Bar in the Columbia River, and its crossdike were strengthened by additional brush and rock delivered in place under contract, the cost of which was $10,521.19. This addition to the St. Helens dike will have the effect to contract the water and keep open and enlarge the channel across the bar which, when last examined, had a low-water depth of 22 feet.

A hydraulic dredge boat was provided for this work during the year, for the purpose of assisting the permanent contraction works in opening the 25-foot channel required by the project. This boat was built and the machinery placed in it by contract. It was finished in the latter part of June and cost, with a complete outfit, $66,000. The boat is 143 feet 6 inches over all, with 38 feet beam.

It is provided with propelling power and with two large centrifugal pumps. There are four bins forward of the midship section, into which the dredged material is delivered. These bins have an aggregate capacity of 500 cubic yards. The material is discharged through a hole in the bottom of each bin. By actual trial the pumps have filled the bins in 45 minutes.

Under the permission granted by the Secretary of War to the Port of Portland Commission to build dikes and do dredging, in accordance with the approved project for obtaining 25 feet depth of water from Portland to the sea, 1,300 feet of dike at Walker Island and 19,700 feet in Cathlamet Bay, in the vicinity of Snag Island, were finished, in addition to the lengths reported as finished in my last annual report. The aggregate length of the dikes built in the Willamette and Columbia rivers by this commission to the end of the fiscal year ending June 30, 1893, is 43,000 feet, a little more than 8 miles. It has dredged during the year 87,150 cubic yards of material; of this amount 25,230 yards was taken from the Swan Island Bar, 5,355 from the mouth of the Willamette River, 32,630 from St. Helens Bar, and 23,935 cubic yards from Martin Island Bar.

The original estimate for procuring the 25-foot channel was $772,464. The port of Portland has expended on this project $381,107.51. In the river and harbor act approved July 13, 1892, an appropriation of $150,000 was made applicable to this purpose. One hundred and fifty-three thousand six hundred dollars can be profitably expended during the fiscal year ending June 30, 1895.

July 1, 1892, balance unexpended	$18,160.03
Amount appropriated by act approved July 13, 1892	150,000.00
	168,160.03
June 30, 1893, amount expended during fiscal year	125,332.61
July 1, 1893, balance unexpended	42,827.42
Amount (estimated) required for completion of existing project	153,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	153,600.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W W 4.)

5. Willamette River above Portland, Oregon.—The project for this improvement was adopted in 1878. It consists in snagging operations, bar scraping, contraction of water over shoals and rock removal, with the object of giving easy navigation for light-draft boats from Portland to Eugene City, Oregon, a distance of 172 miles. The mouth of the Yamhill River, 40 miles above Portland, was the head of an inconvenient low-water navigation in a draft of 2½ feet; only 1 foot could be carried above at the same stage.

Although navigation at stages above low water has been very much improved, there are still some bars on which at low water of last season the governing depth did not exceed 1 foot.

The total amount appropriated for this work since the adoption of the project is $151,000, not including the $3,000 allotted to the improvement of the Yamhill River, Oregon, from the appropriation of July 13, 1892.

The snagging operations during the year extended over the whole river, from Portland to Eugene City.

During the season 1,300 snags and a large quantity of overhanging trees and limbs were removed. Dams for the purpose of closing chutes and concentrating low water over shoal bars to the extent of 635 feet were built.

Yamhill River, Oregon.—The item in the river and harbor act approved July 13, 1892, making appropriation for improving Willamette River at and above Portland, Oregon, provides that $3,000 of the amount appropriated shall be used in removing obstructions in the Yamhill River up to McMinnville.

Under this allotment a small party of men, with teams and ordinary road-scrapers, was engaged about three weeks in August, scraping the bar at the mouth of this river and increasing the channel depth through it to 25 inches at extreme low water. This work permitted the regular steamboats, plying between Portland and Dayton, 5 miles above the mouth of the river, to continue their trips throughout the low-water season.

The crew of the snag boat removed from this reach of the river 126 snags, blasted out 2 rocks and pulled 18 piles, the remains of an old bridge at Dayton.

A small party of men with a skiff, axes, saws, powder, and other outfit necessary for the purpose, was employed during the greater part of October and November, clearing snags, logs, stumps, and overhanging trees from the bed of this river between its mouth and McMinnville, 17 miles above. During this time about 1,200 trees and snags of various description were cut, which floated away during the next rise. In the latter part of November, in consequence of heavy rains, the stream had risen to a 12-foot stage, at which height the rapids at Lafayette

are submerged sufficient to permit of boats passing above them. It was at that time in as good condition for navigation as it is possible to make it. No boats took advantage of this condition to ascend above Dayton.

The cost of this work was $1,526.22, leaving a balance of $1,473.78 from the allotment, to be yet expended.

There is a balance at the end of the fiscal year of $17,477.87 available for work upon the Willamette. This is exclusive of the above-mentioned balance of the allotment for the Yamhill River.

This balance will be expended in the improvement of bars and snagging operations and will be exhausted before the end of the present working season.

July 1, 1892, balance unexpended	$3,113.93
Amount appropriated by act approved July 13, 1892	30,000.00
	33,113.93
June 30, 1893, amount expended during fiscal year	14,162.28
July 1, 1892, balance unexpended	18,951.65
Amount (estimated) required for completion of existing project	60,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W W 5.)

6. Cowlitz River, Washington.—The project for the improvement of this river, adopted in 1882, contemplates the removal of sand bars, rocks, snags, overhanging trees and other obstructions in the channel from its mouth to a point about 50 miles above. Work has been done to Toledo, 30 miles above the mouth. The ruling depth at low water prior to the commencement of this was 14 inches. A low-water depth of 30 inches now prevails. Steamboats can now run to Toledo a month later than formerly.

The original estimate for the improvement was $5,000, for the first year and an annual expenditure thereafter of $2,000 per year. The total amount that has been appropriated for the improvement is $22,000.

During the year a wing dam 329 feet in length was built at Keegans Bar, 3 miles below Toledo; also one at Toutle River Bar 765 feet in length. These dams were both very effective, resulting in a deepening of the water about 15 inches at each place. This work was done by the crew of the Government snag boat. There were 163 snags and overhanging trees removed at the same time.

July 1, 1892, balance unexpended	$2,015.31
Amount appropriated by act approved July 13, 1892	3,000.00
	5,015.31
June 30, 1893, amount expended during fiscal year	2,742.55
July 1, 1893, balance unexpended	2,272.76
Amount that can be profitably expended in fiscal year ending June 30, 1895	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

(See Appendix W W 6.)

7. Youngs and Klaskuine rivers, Oregon.—The project for this improvement contemplates the removal of snags, sunken logs, and overhanging trees from Youngs River as far up as the lower end of the cut-off, a distance of 7 miles; and also from the channel of the Klaskuine

as far up as Kamms Wharf, a distance of 2 miles. The latter river empties into the former 6 miles above Youngs Bay.

The estimated cost of this improvement was $1,600, which has been appropriated. The total amount expended is $1,206.79, which has resulted in a channel of 7 feet at high tide to the limits named. The balance now available, $393.21, will be sufficient to complete the project. No further appropriation is asked.

July 1, 1892, balance unexpended	$393.21
July 1, 1893, balance unexpended	393.21

(See Appendix W W 7.)

8. Gauging waters of Columbia River, Oregon and Washington.—The object of these gaugings is to ascertain and keep a record of the fluctuations of the Columbia River, with the view to gathering information that may be useful in works of improvement on the river, and also by gauges established at various points to indicate to pilots, captains, and others interested in navigation the stage of water on crossings and places of difficult navigation.

A self-registering gauge has been in operation at Astoria, Oregon.

Daily sheets from the Astoria gauge were exhibited on a bulletin board in that city. These show the stage of water and condition as to roughness on the bar at the mouth of the river, and are of great service to commerce.

July 1, 1892, balance unexpended	$446.32
June 30, 1893, amount expended during fiscal year:	350.00
July 1, 1893, balance unexpended	96.32
July 1, 1893, outstanding liabilities	90.00
July 1, 1893, balance available	6.32
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix W W 8.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The preliminary examinations of the following localities, required by act of July 13, 1892, were made by the local engineer, Maj. Thos. H. Handbury, Corps of Engineers, and reports thereon submitted through the Division Engineer, Col. G. H. Mendell, Corps of Engineers.

1. Willamette River above Oregon City, Oregon.—Maj. Handbury submitted report of examination under date of July 28, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river above Oregon City is worthy of improvement by the General Government. The cost of surveys necessary for preparation of project and estimate of cost of improvement is estimated at $12,000. The report was transmitted to Congress and printed as House Ex. Doc. No. 36, Fifty-second Congress, second session. (See also Appendix W W 9.)

2. Yamhill River, Oregon, from mouth to McMinnville, for slack-water navigation by lock and dam at Lafayette.—Maj. Handbury submitted report of examination under date of December 5, 1892. It is his opinion and that of the division engineer, concurred in by this office, that the river is not worthy of improvement by the United States to the extent proposed. The report was transmitted to Congress and printed as House Ex. Doc. No. 145, Fifty-second Congress, second session. (See also Appendix W W 10.)

3. Lewis River, Washington, from its mouth to Speliah Creek.—Maj. Handbury submitted report of examination under date of November 23, 1892. It is his opinion and that of the division engineer, concurred in by this office, that Lewis River is worthy of improvement from its mouth to Etna. The cost of a survey for preparation of project and estimate of cost of improvement is estimated at $500. The report was transmitted to Congress and printed as House Ex. Doc. No. 144, Fifty-second Congress, second session. (See also Appendix W W 11.)

EXAMINATION AND PLAN, BY BOARD OF ENGINEERS, FOR OVERCOMING OBSTRUCTIONS TO NAVIGATION IN COLUMBIA RIVER BETWEEN THREE MILE RAPIDS AND CELILO FALLS, OREGON AND WASHINGTON, IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED JULY 13, 1892.

The river and harbor act approved July 13, 1892, authorized the President to appoint a board of engineers, to consist of seven members, three of them to be civilians, to thoroughly examine the obstructions to navigation in the Columbia River from its navigable waters below Three Mile Rapids to its navigable waters above Celilo Falls, and to report such plan, with estimates of cost, "for overcoming or removing said obstructions as in their opinion is most feasible and best adapted to the necessities of commerce, together with a statement as to the usefulness of such improvement to navigation, its relation and value to commerce, and the most desirable location therefor, the cost of construction and of the right of way, including the necessary land therefor, being considered." The sum of $20,000 was appropriated to defray the cost of the examination and the expenses of the board.

By direction of the President, Col. George H. Mendell, Lieut. Col. Charles R. Suter, Lieut. Col. William R. King, and Maj. Charles J. Allen, Corps of Engineers, and Messrs. William R. Hutton, E. Porter Alexander, and Virgil G. Bogue, civil engineers, were appointed to constitute this board by orders from the War Department dated July 29, 1892. The report of the board was rendered under date of April 12, 1893, and copy thereof was submitted to the Secretary of War June 9, 1893, for transmission to Congress.

The overcoming of the 12 miles of obstructions above Dalles City, 213 miles from the mouth, will, with the completion of the canal at the Cascades, open up through navigation to the upper Columbia River and to the Snake River. Three constructions to effect the object desired at this point have been considered: (*a*) A portage railway, estimated to cost $454,390, if constructed with a view to minimum expenditure, or $682,301, if constructed with a view to subsequent utilization in constructing a boat railway; (*b*) a boat railway, estimated to cost $2,264,467, or if constructed first as a portage railway available for immediate use and then enlarged to a boat railway, $2,517,063; and (*c*) a canal, estimated to cost not over $4,000,000.

The board reports that the obstructions to navigation in the Columbia River from the navigable waters below Three Mile Rapids to the navigable waters above Celilo Falls can be overcome in the most feasible, speedy, and economical manner, and in that best adapted to the present necessities of commerce and to its future development, by the construction of a portage railway at an estimated cost of $454,390, and recommends that further development of commerce demanding greater facilities than could be thereby afforded be provided for, when required, by the construction of a canal.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations, surveys, and contingencies of rivers and harbors an appropriation of $125,000 should be made, as follows:

For examinations, surveys, and contingencies, and for incidental repairs for rivers and harbors, for which there may be no special appropriation; for expenses connected with the inspection of bridges reported as obstructions to navigation, the service of notice required in such cases, and the location of harbor lines as required by the act of September 19, 1890; and for expenses connected with the examinations and reports by officers of the Corps of Engineers and by boards of engineers, upon plans for bridges authorized by law to be constructed, and upon bridge bills, reports on which may be called for by Congress, $125,000.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the year was Capt. Frederick Rodgers, U. S. Navy.

The office and functions of the supervisor of the harbor of New York were established by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City by dumping or otherwise, and to punish and prevent such offenses."

Under the provisions of section 5 of the act a line officer of the Navy is designated to discharge the duties created by the act, under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers. The report of the supervisor of the harbor, describing the operations in his charge for the fiscal year ending June 30, 1893, is submitted as Appendix X X.

Estimates for the fiscal year ending June 30, 1895.—The estimate of funds required for this service for the fiscal year ending June 30, 1895, is given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office	$20,000
For pay of crew and maintenance of steamer *Nimrod*	10,000
For pay of crew and maintenance of steamer *Argus*	10,000
For purchase or construction of two steam tugs	90,000
For pay of crew and maintenance of two steam tugs to be purchased or constructed	24,000
Total	154,000

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of Mississippi River between the mouth of Ohio River and the head of the Passes and of surveys of the entire river.

The commissioners during the past year were Col. C. B. Comstock, Corps of Engineers, president; Lieut. Col. Charles R. Suter, Corps of Engineers; Maj. O. H. Ernst, Corps of Engineers; Henry L. Whiting, assistant, U. S. Coast and Geodetic Survey; B. M. Harrod, Robert S. Taylor, and Henry Flad.

The report of the Commission upon the operations under its charge for the fiscal year ending June 30, 1893, is submitted as Appendix Y Y.

Estimates for the fiscal year ending June 30, 1895.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1895, are submitted by the Commission:

For improving Mississippi River from head of the Passes to the mouth of Ohio River, including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission	$2,665,000
For improving harbors at—	
New Madrid, Mo	75,000
Memphis, Tenn	100,000
Greenville, Miss	200,000
Vicksburg, Miss. (Delta Point)	150,000
Natchez, Miss., and Vidalia, La	400,000
New Orleans, La	300,000
For improvement at head of Atchafalaya and mouth of Red River, Louisiana	350,000
Total	4,240,000

MISSOURI RIVER COMMISSION.

The Missouri River Commission, constituted by act of Congress of July 5, 1884, is in charge of the improvement and surveys of the Missouri River below Sioux City, Iowa.

The commissioners during the past year were Lieut. Col. Charles R. Suter, Corps of Engineers, president; Maj. A. Mackenzie, Corps of Engineers; Maj. O. H. Ernst, Corps of Engineers; G. C. Broadhead, and R. S. Berlin.

The report of the Commission upon the operations under its charge for the fiscal year ending June 30, 1893, is submitted as Appendix Z Z.

Estimates for the fiscal year ending June 30, 1895.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1895, are submitted by the Commission:

Office and traveling expenses, and salaries of Commission	$20,000
Surveys, gauges, physical data, and publications	30,000
Operating snag boat	35,000
Systematic improvement in first reach	665,000
Total	750,000

CALIFORNIA DÉBRIS COMMISSION.

Act of Congress approved March 1, 1893, provided for the establishment of the California Débris Commission, to consist of three officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate, whose functions relate to hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems in California. The Commission is empowered and required to adopt plans for improving the navigation of the rivers in the systems mentioned, to project and construct works for impounding detritus and preventing the deterioration of the rivers from the deposit of hydraulic-mining and other débris, and to devise means and issue permits for resuming and carrying on hydraulic-mining operations under conditions that will not injure other interests in the State. The powers of the Commission, methods of procedure, etc., are prescribed in the act in detail.

The commissioners appointed May 3, 1893, by the President are Col. G. H. Mendell, Lieut. Col. W. H. H. Benyaurd, and Maj. W. H. Heuer, Corps of Engineers.

The annual report of the Commission, with plans and estimates, which the act requires to be submitted on or before November 15 of each year to the Chief of Engineers for transmission to the Secretary of War and Congress, will be submitted when received.

HARBOR LINES.

The existing provisions of United States law relating to the establishment of harbor lines are contained in section 12 of the river and harbor act approved September 19, 1890, as follows:

SEC. 12. That section 12 of the river and harbor act of August 11, 1888, be amended and reënacted so as to read as follows:

Where it is made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of harbors he may, and is hereby authorized to, cause such lines to be established beyond which no piers, wharves, bulkheads, or other works shall be extended or deposits made, except under such regulations as may be prescribed from time to time by him; and any person who shall willfully violate the provisions of this section, or any rule or regulation made by the Secretary of War in pursuance of this section, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding $1,000, or imprisonment not exceeding one year, at the discretion of the court, for each offense.

Cases where the establishment of harbor lines at particular harbors has appeared to be essential to their preservation and protection have been considered by the local engineer officers or by boards of engineers constituted for the purpose, and reports thereon submitted, with maps, indicating the lines recommended for establishment by the War Department; and the reports have been submitted to the Secretary of War with the recommendations of this office. Under the provisions of the law and in this manner harbor lines have been established by the Secretary during the year at the following localities, the correspondence and reports being submitted as appendixes to this report:

Shaws Cove, New London Harbor, Connecticut.—Under date of January 20, 1893, Col. D. C. Houston, Corps of Engineers, submitted a report, with map, proposing and recommending establishment of harbor lines in Shaws Cove; approved by the Secretary of War January 26, 1893. (See Appendix D 32.)

Bridgeport Harbor, Connecticut.—The Board of Engineers on harbor lines at Bridgeport, constituted by Special Orders No. 29, Headquarters, Corps of Engineers, May 12, 1891, consisting of Col. D. C. Houston, Lieut. Col. G. L. Gillespie, and Capt. Thomas L. Casey, Corps of Engineers, made report under date of January 4, 1892; approved by the Secretary of War July 1, 1893. (See Appendix D 33.)

New York Harbor and its adjacent waters.—The Board of Engineers on harbor lines for New York Harbor and its adjacent waters, consisting of Cols. Henry L. Abbot, William P. Craighill, C. B. Comstock, and D. C. Houston, and Lieut. Col. G. L. Gillespie, Corps of Engineers, constituted by Special Orders No. 11, Headquarters, Corps of Engineers, January 30, 1889, submitted reports as follows:

a. The board submitted a report, dated January 16, 1893, recommending modification of the harbor lines around Rikers Island, East River, established January 9, 1891 (see Annual Report, Chief of Engineers, 1891, pp. 963–965), at the request of the city of New York and to enable it to carry out contemplated improvements on the island; the modified lines were approved by the Secretary of War January 24, 1893.

b. At the request of riparian owners who had inadvertently, owing to indefinite location of the established lines, constructed piers extend-

ing beyond the harbor lines established by the Secretary of War February 8 and March 4, 1890 (see Annual Report, Chief of Engineers, 1890, pp. 791 and 810), the board, in report of January 16, 1893, recommended modification of the lines on east shore of East River at Ravenswood, Long Island, so as to afford relief; the modified line was approved by the Secretary of War June 1, 1893.

(See Appendix E 16.)

Savannah River in vicinity of quarantine station near Fort Pulaski, Savannah, Ga.—At the instance of the mayor of Savannah, Ga., and in compliance with instructions from this office, Capt. O. M. Carter, Corps of Engineers, on January 10, 1893, submitted a report and map proposing and recommending for establishment a harbor line in Savannah River in the vicinity of the quarantine station near Fort Pulaski; the line was approved by the Secretary of War January 19, 1893. (See Appendix N 15.)

Allouez Bay, near Superior, Wis.—Maj. Clinton B. Sears, Corps of Engineers, submitted report March 20, 1893, with map, proposing and recommending establishment of harbor lines in Allouez Bay, near Superior, Wis.; approved by the Secretary of War March 30, 1893. (See Appendix J J 13.)

Oconto Harbor, Wisconsin.—At the request of citizens of Oconto, Maj. James F. Gregory, Corps of Engineers, in report of May 9, 1893, proposed and recommended for establishment harbor lines at this locality; the lines were approved by the Secretary of War June 23, 1893. (See Appendix K K 29.)

Milwaukee River, Milwaukee, Wis.—At the request of the authorities of the city of Milwaukee, Wis., recommended by Maj. James F. Gregory, Corps of Engineers, a modification of the dock lines established by the city in Milwaukee River was approved by the Secretary of War August 30, 1893. (See Appendix K K 30.)

Black River at Port Huron, Mich.—At the instance of the city authorities of Port Huron, Maj. William Ludlow, Corps of Engineers, in report of July 15, 1893, proposed and recommended for establishment harbor lines in Black River at that locality; the lines were approved by the Secretary of War July 21, 1893. (See Appendix M M 31.)

St. Marys River at Sault Ste. Marie, Mich.—At the request of the common council of the city and in compliance with instructions from this office, Col. O. M. Poe, Corps of Engineers, on March 23, 1893, submitted a report, with maps, recommending a harbor line along the river front of Sault Ste. Marie, Mich.; approved by the Secretary of War April 22, 1893. (See Appendix N N 9.)

Detroit, Mich.—The Board of Engineers on harbor lines at Detroit, consisting of Col. O. M. Poe, Maj. William Ludlow, and Lieut. Chas. S. Riché, Corps of Engineers, constituted by Special Orders No. 61, Headquarters, Corps of Engineers, October 5, 1891, made report dated September 8, 1892; approved by the Secretary of War September 24, 1892. (See Appendix N N 10.)

Oswego, N. Y.—The Board of Engineers on harbor lines at Oswego, N. Y., consisting of Col. Henry L. Abbot, Maj. E. H. Ruffner, and Capt. Dan C. Kingman, Corps of Engineers, constituted by Special Orders No. 28, Headquarters, Corps of Engineers, June 22, 1892, made report dated November 30, 1892; approved by the Secretary of War January 10, 1893. (See Appendix Q Q 8.)

Ports in the State of Washington.—In accordance with a request of the harbor line commission of the State of Washington, dated March

1, 1892, harbor lines at Vancouver and Olympia and in Bellingham Bay were considered by a Board of Engineers, consisting of Col. G. H. Mendell, Maj. Thos. H. Handbury, and Capt. Thos. W. Symons, Corps of Engineers, constituted for the purpose by Special Orders No. 16, Headquarters, Corps of Engineers, March 12, 1892, and were established by the Secretary of War June 3, 1892. (See Annual Report, Chief of Engineers, 1892, pp. 399, 2794.)

In accordance with further requests of the Washington harbor line commission, dated April 18 and September 30, 1892, the above board was further charged with the duty of considering and reporting upon the subject of establishing harbor lines at Aberdeen, Anacortes, Ballard, Blaine, Cosmopolis, Edmonds, Hoquiam, Ilwaco, La Conner, Marysville, Ocosta, Port Angeles, Port Townsend, Seattle, Shelton, Sidney, Snohomish City, South Bend, Steilacoom, and Tacoma, Wash. (twenty localities in all).

Reports, dated September 19, 1892, and January 4, 1893, have been submitted by the board, and harbor lines have been approved by the Secretary of War for ten of these localities, as follows: Aberdeen, Blaine, Cosmopolis, Edmonds, Ilwaco, Ocosta, Port Townsend, Sidney, Steilacoom, lines approved October 27, 1892; Shelton, lines approved May 8, 1893.

(See Appendix V V 30.)

Columbia River (Youngs Bay) at Flavel, Oregon.—The Board of Engineers constituted by Special Orders No. 16, Headquarters, Corps of Engineers, March 12, 1892, consisting of Col. G. H. Mendell, Maj. Thos. H. Handbury, and Capt. Thos. W. Symons, Corps of Engineers, was charged with the duty of considering the subject of harbor lines for Flavel, Oregon, at the mouth of Columbia River. The report of the board was submitted June 16, 1893, recommending lines for this locality in extension of those for Astoria Harbor and Youngs Bay established by the Secretary of War April 22, 1891 (see Annual Report, Chief of Engineers, 1891, pp. 427, 3387); approved by the Secretary of War June 29, 1893. (See Appendix W W 12.)

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and locations of the following bridges proposed to be erected under the authority of special acts of Congress have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War as provided by the acts; and the local engineer officers have been furnished with copies of the instruments of approval and drawings showing plans and locations, and charged with supervision of the construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. Bridge of the Marietta and North Georgia Railway Company (successor to the Knoxville Southern Railroad Company) across Tennessee River at Knoxville, Tenn.—The construction of this bridge by the Knoxville Southern Railroad Company was authorized by act of Congress of August 9, 1888, amended as to the time within which the bridge was to be commenced and completed by act of July 26, 1892. Plan and location for a bridge at this point to be built by the Knoxville Southern Railroad were approved by the Secretary of War February 27, 1890. Modified plans were submitted by the Marietta and North Georgia Railway Company, into which the original company had been merged, July 2, 1892; approved by the Secretary of War Septem-

ber 29, 1892, on the understanding that the merger and consolidation of the original grantee with another company was not recognized thereby. Copy of the instrument of approval was sent to Lieut. Col. Henry M. Robert, Corps of Engineers, October 4, 1892.

Lieut. Col. Robert, on February 8, 1893, reported that the bridge was completed practically in accordance with the plans approved September 29, 1892.

2. Bridge of the Saint Paul, Minneapolis and Manitoba Railway Company across Columbia River between Douglas and Kittitas counties, Wash.—The company submitted plan and location for the bridge September 30, 1892. The act of Congress granting the necessary authority for its construction was approved January 10, 1893. The plans were approved by the Secretary of War February 14, 1893; and copy of the instrument of approval was sent to Capt. Thomas W. Symons, Corps of Engineers, February 17, 1893.

3. Bridge of the Chesapeake and Ohio Railroad Company across Big Sandy River at Catlettsburg, Ky.—The company submitted plans and location for construction, under authority of act of Congress approved February 15, 1893, of bridge to replace its existing structure at this point; plans approved by the Secretary of War February 25, 1893; copy sent to Maj. D. W. Lockwood, Corps of Engineers, February 27, 1893.

4. Bridge of the Newport and Cincinnati Bridge Company across Ohio River at Cincinnati, Ohio.—This bridge, as originally built under the provisions of a resolution of Congress approved March 3, 1869, and an act approved March 3, 1871, had a channel span about 400 feet in clear width and 98.1 feet in clear height (1.9 feet less than required by Congress). The general laws of December 17, 1872, and February 14, 1883, enacted subsequent to the completion of this bridge, require a clear width of 500 feet and clear headway of 102.1 feet above low water in bridges over this part of the Ohio River. The bridge in question as originally constructed has been an obstruction to navigation.

The company, on February 15, 1893, submitted plans for reconstruction of the bridge providing for widening the structure, but not altering the dimensions of the channel span. It was recommended by the local engineer officer and this office that in rebuilding the bridge the company be required to provide a channel span of the dimensions, 500 feet wide and 102.1 feet high, required by existing law. The plans submitted by the company were approved by the Secretary of War March 6, 1893; and copy was sent to Lieut. Col. Amos Stickney, Corps of Engineers, April 14, 1893.

5. Bridge of the West Elizabeth Bridge Company across Monongahela River at Elizabeth, Pa.—Plans and location were submitted by the company June 17, 1892, and modified plans August 25, 1892, and February 28, 1893. The act of Congress granting authority for construction of the bridge was approved February 15, 1893. The plans and location were approved by the Secretary of War March 18, 1893; and copy of the instrument of approval was sent to Lieut. Col. Amos Stickney, Corps of Engineers, March 21, 1893.

6. Bridge of the Florida Central and Peninsular Railroad Company across St. Marys River, Georgia and Florida.—Plans and location were submitted by the company January 16, 1893. The act of Congress authorizing construction of the bridge was approved February 14, 1893. The plans and location were approved by the Secretary of War March 28, 1893; copy sent to Capt. O. M. Carter, Corps of Engineers, April 1, 1893.

7. Bridge of the Southern Bridge and Railway Company across Mississippi River above New Orleans, La.—The construction of this bridge was authorized by act of Congress approved January 26, 1893. Plans and location were submitted by the company April 17, 1893; approved by the Secretary of War April 19, 1893; copy sent to Capt. John Millis, Corps of Engineers, May 15, 1893.

8. Bridge of the Occidental Bridge and Construction Company across Missouri River at St. Charles, Mo.—The construction of this bridge was authorized by act of May 23, 1892. Plans and location were submitted by the company February 21, 1893, and modified plans April 11, 1893; approved by the Secretary of War April 29, 1893; copy sent to Lieut. Col. Chas. R. Suter, Corps of Engineers, May 15, 1893.

9. Bridge of the Omaha Bridge and Terminal Railway Company (formerly the Interstate Bridge and Street Railway Company) across Missouri River between Council Bluffs, Iowa, and East Omaha, Nebr.—The construction of this bridge was authorized by act of February 13, 1891, amended by act of January 28, 1893. Plans and location were originally approved March 5, 1891 (see Annual Report, Chief of Engineers, 1891, page 431). Modified plans were submitted by the company March 10, 1893; approved by the Secretary of War May 9, 1893; copy sent to Lieut. Col. Chas. R. Suter, Corps of Engineers, May 19, 1893.

10. Bridge of the Litchfield, Carrollton and Western Railroad Company across Illinois River at Columbiana, Ill.—Plans for construction of this bridge under authority of acts of March 3, 1883, and October 1, 1890, were approved by the Secretary of War November 4, 1891 (see Annual Report, Chief of Engineers, 1892, page 401). The company submitted a proposed slight modification of the plans April 17, 1893, which was approved by the Secretary of War May 9, 1893; copy sent to Capt. W. L. Marshall, Corps of Engineers, May 11, 1893.

11. Bridge of the Homestead and Pittsburgh Bridge Company across Monongahela River between Pittsburg and Homestead, Pa.—The construction of this bridge was authorized by act of February 14, 1893. Plans and location were submitted by the company March 9, and modified plans April 20, 1893; approved by the Secretary of War May 24, 1893; copy sent to Lieut. Col. Amos Stickney, Corps of Engineers, May 26, 1893.

12. Bridge of the Natchitoches Cane River Bridge Company across Cane River at Natchitoches, La.—The construction of this bridge was authorized by act of April 22, 1890, amended by act of January 9, 1893. Plans and location were submitted May 24, 1893; approved by the Secretary of War July 1, 1893; copy sent to Capt. J. H. Willard, Corps of Engineers, July 7, 1893.

13. Trestle and bridges of the Mobile and Dauphin Island Railroad and Harbor Company from Cedar Point to Dauphin Island, Alabama, across the shoal water between Mobile Bay and Mississippi Sound.—The construction of this bridge was authorized by act of September 26, 1890, amended by act of February 28, 1893. Plans and location were submitted by the company September 10, 1892; approved by the Secretary of War August 21, 1893; copy sent to Maj. A. N. Damrell, Corps of Engineers, August 24, 1893.

Under the provisions of section 7 of river and harbor act approved September 19, 1890, amended by section 3 of river and harbor act approved July 13, 1892, bridges may be built over navigable waters entirely within the limits of any State, under the authority of legislative enactment of such State, when the plans and locations of the

structures are approved by the Secretary of War. Plans and locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War; and the local engineer officers have been furnished with copies of the drawings and instruments of approval, and charged with supervision of construction of the bridges so far as necessary to see that they are built in accordance with the approved plans.

1. Bridge of the Youghiogheny Central Railway Company across Youghiogheny River in Fayette County, Pa.—Plan and location were submitted by the company August 17, 1892; approved by the Secretary of War September 24, 1892; copy sent to Lieut. Col. Amos Stickney, Corps of Engineers, September 28, 1892.

2. Bridge of the State Line Railroad Company across Cheat River at Point Marion, Pa.—Plan and location were submitted by the company July 26, 1892; approved by the Secretary of War September 24, 1892; copy sent to Lieut. Col. Amos Stickney, Corps of Engineers, September 27, 1892.

3. Bridge of Stanislaus County, Cal., across San Joaquin River near Grayson.—Plan and location were submitted by the board of supervisors September 1, 1892; approved by the Secretary of War September 29, 1892; copy sent to Maj. W. H. Heuer, Corps of Engineers, October 1, 1892.

June 10, 1893, Major Heuer reported that this bridge had been completed in accordance with the approved plans.

4. Bridge of the Philadelphia Belt Line Railroad Company across Frankford Creek, Philadelphia.—Plan and location were submitted by the company July 29, 1892; approved by the Secretary of War September 30, 1892; copy sent to Maj. C. W. Raymond, Corps of Engineers, October 18, 1892.

5. Bridge of the North Galveston, Houston and Kansas City Railroad Company across Dickinson Bayou, Texas, about one-half mile above its mouth.—Plan and location were submitted by the company August 31, 1892; approved by the Secretary of War October 13, 1892; copy sent to Maj. C. J. Allen, Corps of Engineers, October 15, 1892.

6. Bridge of the city of Kewaunee, Wis., across Kewaunee River, at Park Street.—Plans were submitted by the city July 2, 1892, for construction of a bridge in lieu of the existing structure; approved by the Secretary of War October 14, 1892; copy sent to Maj. James F. Gregory, Corps of Engineers, October 17, 1892.

7. Bridge of the Pennsylvania Railroad Company across Hackensack River, New Jersey.—Plan was submitted by the company September 22, 1892, for construction of bridge to replace the existing structure; approved by the Secretary of War October 20, 1892; copy sent to Capt. Thos. L. Casey, Corps of Engineers, October 26, 1892.

8. Bridge of the Lake Shore and Michigan Southern Railway Company across Sandusky Bay, Ohio.—Plans for this bridge with clear draw openings of 60 feet were approved by the Secretary of War January 16, 1892 (see Annual Report, Chief of Engineers, 1892, page 403). On November 2, 1892, the company submitted modified plans providing for clear draw spans of 65 feet; approved by the Secretary of War November 18, 1892; and Lieut. Col. Jared A. Smith, Corps of Engineers, was advised November 23, 1892.

9. Bridge of the Missouri, Kansas and Texas Railway Company of Texas across White Oak Bayou at Houston, Tex.—Plan and location were submitted by the company September 17, 1892; approved by the

Secretary of War November 28, 1892; copy sent to Maj. Chas. J. Allen, Corps of Engineers, November 30, 1892.

10. Bridge of the Chesapeake and Ohio Railway Company across Gauley River, West Virginia.—Plan and location were received October 18, 1892; approved by the Secretary of War December 21, 1892; copy sent to Col. Wm. P. Craighill, Corps of Engineers, December 24, 1892.

11. Bridge of San Joaquin County, Cal., across San Joaquin River at Garwood Ferry crossing.—Plan and location were submitted by the board of supervisors November 6, 1892; approved by the Secretary of War January 3, 1893; copy sent to Maj. W. H. Heuer, Corps of Engineers, January 6, 1893.

12. Bridge of Glenn County, Cal., across Sacramento River at Butte City.—Plan and location were submitted by the board of supervisors October 25, 1892; approved by the Secretary of War January 4, 1893; copy sent to Maj. W. H. Heuer, Corps of Engineers, January 7, 1893.

June 22, 1893, Maj. Heuer reported that this bridge had been completed in accordance with the approved plans.

13. Bridge of the city of Chicago, Ill., across South Branch of Chicago River at South Halsted street.—Plans and location were submitted by the department of public works October 29, 1892; approved by the Secretary of War January 13, 1893; and copy of the instrument of approval was sent to Capt. W. L. Marshall, Corps of Engineers, January 16, 1893.

14. Bridge of the Wilmington, Columbia and Augusta Railroad Company across Lumber River, North Carolina.—Plan and location were received December 5, 1892; approved by the Secretary of War January 26, 1893; copy sent to Capt. F. V. Abbot, Corps of Engineers, January 28, 1893.

15. Bridges of the Boston and Maine Railroad Company across Charles River in Boston and Cambridge, Mass.—Plans for certain alterations of its bridges over Charles River were received from the company January 31, 1893. The proposed changes were approved by the Secretary of War February 3, 1893, on condition that within 10 years the company rebuild all its bridges over Charles River on stone or iron piers in a manner to be approved by the War Department, and remove all of the piles of the bridges. Copy of the instrument was sent to Lieut. Col. S. M. Mansfield, Corps of Engineers, February 10, 1893.

16. Bridge of the city of New York across Harlem River, New York, at Broadway crossing.—In compliance with the requirements of act of Congress of September 19, 189', plan and location were submitted by the department of public works April 28, 1892, and new plans, slightly modified, January 31, 1893; approved by the Secretary of War February 11, 1893; copy sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, February 15, 1893.

17. Bridge of the Chicago and Northern Pacific Railroad Company across West Fork of South Branch of Chicago River, in Chicago, Ill.—Plan and location were submitted by the company January 19, 1893; approved by the Secretary of War February 15, 1893; copy sent to Capt. W. L. Marshall, Corps of Engineers, February 17, 1893.

18. Bridges of the East River Bridge Company across East River, New York, between New York and Brooklyn.—On October 15, 1892, the company submitted plans for two bridges above and below the navy yard, one from a point near Broadway in Brooklyn, between the pier line and Marcy avenue, to a point between Delancey and Rivington streets in New York, the other from a point between the pier line and

Fulton street in Brooklyn, between Bridge and Little streets, to a point between Jackson and Scammel streets in New York; the proposed clear height of these bridges was practically the same as that of the existing East River Bridge—135 feet at the center of the span and 120 feet at the piers above mean high water. The plans were considered by The Board of Engineers in New York City; careful consideration was especially given to the question of the proper clear height, and a public hearing of all parties interested was held. In its report, dated November 5, 1892, which was concurred in by this office, the Board recommended that the bridges be required to have a clear height, at mean high water, of 145 feet at the center of the spans and 120 feet at the piers, under the most unfavorable conditions of load and temperature. January 17, 1893, the Secretary of War prescribed that the clear height at the center of the span of the upper bridge, between Broadway avenue and a point between Delancey and Rivington streets, should be 140 feet at mean high water under the most unfavorable conditions.

The Attorney-General rendered an opinion, November 2, 1892, that the East River is entirely within the limits of New York State and that the approval of the plans of these bridges was therefore within the authority of the Secretary of War under the act of July 13, 1892.

Modified plans for the upper bridge conforming to the requirement as to height fixed by the Secretary of War were submitted by the company January 19, 1893. The plans for both bridges were approved by the Secretary of War February 16, 1893, and copy of the instrument of approval was sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, February 18, 1893.

19. Bridge of the Wabash Railroad Company across Rouge River near Detroit, Mich.—Plan and location for construction of a drawbridge to replace the existing structure were submitted by the company November 3, 1892; approved by the Secretary of War February 16, 1893, on condition that the old bridge, with its central pier, be removed, and Maj. William Ludlow, Corps of Engineers, was charged with supervision of the construction of the bridge February 23, 1893.

20. Bridges of the Florida Central and Peninsular Railroad Company on the line of its Savannah extension across Ogeechee, Altamaha, and Satilla rivers, Georgia.—Plans and locations were submitted by the company January 16, 1893; approved by the Secretary of War February 21, 1893; copies sent to Capt. O. M. Carter, Corps of Engineers, February 25, 1893.

21. Bridge of Whatcom County, Wash., across Nooksack River at Ferndale.—Plans for this bridge were approved by the Secretary of War August 4, 1892 (see Annual Report, Chief of Engineers, 1892, page 408). Application for modification of approved plan so as to permit extension of the draw rest upstream was submitted January 14, 1893; the modification was approved by the Secretary of War February 25, 1893; copy sent to Capt. Thomas W. Symons, Corps of Engineers, February 28, 1893.

22. Bridge of the city of North Muskegon, Mich., across Muskegon Lake.—Plans and location were submitted by the city February 15, 1892; approved by the Secretary of War March 1, 1893; copy sent to Maj. William Ludlow, Corps of Engineers, March 3, 1893.

23. Bridge of the city of Muskegon, Mich., across Muskegon River.—Plans and location were submitted by the city February 19, 1892; approved by the Secretary of War March 11, 1893; copy sent to Maj. William Ludlow, Corps of Engineers, March 18, 1893.

24. Bridges of the city of New York across Harlem River at Third Avenue.—The city bridge at this locality being an obstruction to navigation, a notice from the Secretary of War, dated July 2, 1890, was served upon the city, under the provisions of sections 9 and 10 of the river and harbor act of August 11, 1888, requiring alteration of the bridge by January 2, 1892, so as to render navigation through it unobstructed (see Annual Report, Chief of Engineers, 1890, pp. 344 and 3484-3488). The river and harbor act approved September 19, 1890, also required reconstruction of the low bridges over Harlem River. Necessary legislative action from the State having been obtained, the department of public works on February 24, 1893, submitted plans for reconstruction of the bridge to comply with the requirements imposed, and for the erection of a temporary bridge; the plans were approved by the Secretary of War March 24, 1893, and copy was sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, March 28, 1893.

25. Bridge of San Joaquin County, Cal., across south fork of Mokelumne River at New Hope Landing.—Plans and location were submitted by the board of supervisors January 18, 1893; approved by the Secretary of War March 24, 1893; copy sent to Maj. W. H. Heuer, Corps of Engineers, March 27, 1893.

June 30, 1893, Major Heuer reported that this bridge had been completed in accordance with the approved plans.

26. Bridge of the Long Island Railroad Company across Dutch Kills Creek, at Long Island City, N. Y.—Plans for reconstruction of the bridge were submitted by the company November 22, 1892; approved by the Secretary of War March 27, 1893; copy sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, March 29, 1893.

27. Temporary bridge of the Lynn and Boston Railroad Company across Mystic River at Boston, Mass.—Plan and location were submitted by the company March 25, 1893; approved by the Secretary of War April 13, 1893; copy sent to Lieut. Col. S. M. Mansfield, Corps of Engineers, April 17, 1893.

28. Bridge of the city of Milwaukee, Wis., across Milwaukee River.—Plans and location were submitted by the city engineer March 27, 1893; approved by the Secretary of War April 14, 1893; copy sent to Maj. J. F. Gregory, Corps of Engineers, April 18, 1893.

29. Bridge of the Mount Pleasant and Seaview City Railroad Company across cove at Sullivans Island, Charleston Harbor, South Carolina.—Plans and location were submitted by the company March 14, 1893; approved by the Secretary of War April 18, 1893; copy sent to Capt. Frederic V. Abbot, Corps of Engineers, April 28, 1893.

30. Bridge of the Louisville, St. Louis and Texas Railway Company across Salt River near West Point, Ky.—Plans and location were submitted by the company February 20, 1893, and modified plans April 12, 1893; approved by the Secretary of War May 15, 1893; copy sent to Lieut. Col. G. J. Lydecker, Corps of Engineers, May 18, 1893.

31. Bridge of the Harlem River and Portchester Railroad Company across Bronx River below West Farms, N. Y.—Plans for reconstruction of bridge at this point were submitted by the company April 21, 1893; approved by the Secretary of War May 17, 1893; copy sent to Lieut. Col. G. L. Gillespie, Corps of Engineers, May 23, 1893.

32. Bridge of the Jacksonville, Tampa and Key West Railway Company across St. Johns River at foot of Lake Monroe, Florida.—Plans for reconstruction of this bridge were submitted by the company May 3, 1893; approved by the Secretary of War June 1, 1893; copy sent to Maj. J. C. Mallery, Corps of Engineers, June 8, 1893.

33. Bridge of the Labadieville Bridge Company across Bayou Lafourche at Labadieville, La.—Plans and location were submitted by the company May 10, 1893; approved by the Secretary of War June 2, 1893; copy sent to Maj. James B. Quinn, Corps of Engineers, June 5, 1893.

34. Bridge of the Napoleonville Bridge Stock Company across Bayou Lafourche, at Napoleonville, La.—Plans and location were submitted by the company May 5, 1893; approved by the Secretary of War June 5, 1893; copy sent to Maj. James B. Quinn, Corps of Engineers, June 7, 1893.

35. Bridge of the Manchester and Augusta Railroad Company across Santee River, about 17 miles below mouth of Congaree River, Georgia.—Plans and location were submitted by the company June 7, 1893; approved by the Secretary of War June 20, 1893; copy sent to Capt. F. V. Abbot, Corps of Engineers, June 22, 1893.

36. Bridge of Orange County, Tex., across Cow Bayou, about 6 miles above its confluence with Sabine River.—Plans and location were received June 27, 1893; approved by the Secretary of War July 6, 1893; copy sent to Maj. A. M. Miller, Corps of Engineers, July 10, 1893.

37. Bridge of the Tarentum Bridge Company across Allegheny River at New Kensington, Pa.—Plans and location were submitted by the company April 24, 1893, and amended plans July 1, 1893; approved by the Secretary of War July 10, 1893; copy sent to Lieut. Col. Amos Stickney, Corps of Engineers, July 12, 1893.

38. Bridge of the city of Boston, Mass., across Fort Point Channel at Dover street.—Plans for reconstruction of this bridge were submitted June 26, 1893; approved by the Secretary of War July 12, 1893; copy sent to Lieut. Col. S. M. Mansfield, Corps of Engineers, July 20, 1893.

39. Bridge of the city of Milwaukee, Wis., across North Menomonee Canal at Sixteenth street.—Plans and location were submitted by the city engineer July 12, 1893; approved by the Secretary of War July 29, 1893; copy sent to Maj. James F. Gregory, Corps of Engineers, August 1, 1893.

40. Bridge of the city of Milwaukee, Wis., across Kinnickinnic River at Clinton street.—Plans for construction of a new bridge to replace an old structure were approved by the Secretary of War September 12, 1892 (see Annual Report, Chief of Engineers, 1892, p. 410). Application for approval of a modification of the original plans, so as to authorize a slight decrease of the length of the clear channel ways, was made by the city engineer July 12, 1893; approved by the Secretary of War July 29, 1893; copy sent to Maj. James F. Gregory, Corps of Engineers, August 1, 1893.

41. Bridge of Knox County, Tenn., across Holston River near Boyds Ferry, near Knoxville.—Plans and location were submitted July 20, 1893; approved by the Secretary of War August 2, 1893; copy sent to Capt. John Biddle, Corps of Engineers, August 3, 1893.

42. Bridge of the Jacksonville, Tampa and Key West Railway Company across McGirts Creek, Duval County, Fla.—Plans for reconstruction of this bridge were submitted by the company June 27, 1893, and amended plans August 4, 1893; approved by the Secretary of War August 15, 1893; copy sent to Lieut. A. M. D'Armit, Corps of Engineers, August 21, 1893.

43. Bridge of the Jacksonville, Tampa and Key West Railway Company across Black Creek, Clay County, Fla.—Plans for reconstruction of this bridge were submitted by the company July 24, 1893; approved

by the Secretary of War August 15, 1893; copy sent to Lieut. A. M. D'Armit, Corps of Engineers, August 16, 1893.

44. Bridge of the Jacksonville, St. Augustine and Indian River Railway Company across St. Lucie River, Florida.—Plans and location were submitted by the company July 24, 1893; approved by the Secretary of War August 15, 1893; copy sent to Lieut. A. M. D'Armit, Corps of Engineers, August 16, 1893.

45. Bridge of the Jacksonville, St. Augustine and Indian River Railway Company across Jupiter River, Florida.—Plans and location were submitted by the company July 24, 1893; approved by the Secretary of War August 15, 1893; copy sent to Lieut. A. M. D'Armit, Corps of Engineers, August 21, 1893.

Under the provisions of sections 4 and 5 of the river and harbor act approved September 19, 1890, relating to bridges obstructing navigation, plans for alteration of the following bridges so as to render navigation unobstructed have been examined and approved by the Secretary of War; and the local engineer officers have been furnished with copies of the plans and instruments of approval, and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

1. Bridge of the Louisville and Nashville Railroad Company across Kentucky River at Frankfort, Ky.—Under the provisions of act of Congress of September 19, 1890, notice from the Secretary of War, dated August 28, 1891, was served on the company September 14, 1891, requiring that, in order to render navigation under it reasonably free, easy, and unobstructed, the bridge be raised 10 feet, so as to make its clear height above the normal level of Pool 4 of Kentucky River 48 feet 4 inches, the alterations to be completed by September 1, 1892. (See Annual Report, Chief of Engineers, 1891, p. 436.) On July 22, 1892, the Secretary of War, in accordance with a proposition of the railroad company of May 17, 1892, authorized the reconstruction of the bridge, with spans not less than those of the original bridge, and with an additional clear height of 5 feet (43 feet 4 inches clear head room in all), the work to be done by September 1, 1893. Plans for the reconstruction of the bridge were submitted by the company September 17, 1892, in accordance with these conditions, and approved by the Secretary of War October 24, 1892; copy of the instrument of approval was sent to Maj. D. W. Lockwood, Corps of Engineers, October 25, 1892.

2. Bridge of the Chicago and West Michigan Railway Company across St. Joseph River, Michigan, near its mouth.—Under the provisions of the act of August 11, 1888, a notice from the Secretary of War, dated December 4, 1888, was served on the railway company requiring alteration of the bridge so as to make navigation through it reasonably free, easy, and unobstructed, in pursuance of which a draw was provided in it with two clear openings of 100 feet each. As, however, certain obstructions remained in the draw passages, a further notice, dated September 12, 1890, was served on the company (see Annual Report, Chief of Engineers, 1890, p. 340).

Notice from the Secretary of War, dated December 10, 1891, under the provisions of the act of September 19, 1890, was served on the company, requiring (1) removal of all obstructions to navigation in the existing draw openings to a depth of 15 feet, the work to be completed by May 15, 1892, and (2) construction of an additional draw to accommodate navigation in the north channel of the harbor, to be completed by November 1, 1892 (see Annual Report, Chief of Engineers, 1892, p. 411).

Protest being made by the company to the requirement for constructing an additional draw for the north channel, on February 27, 1892, a proposition was made by the Secretary of War that if the removal of obstructions and dredging required at the existing draw passages should be done by July 15, 1892, an application from the company for modification or revocation of the order for a draw at the north channel would then be considered. The removal of the obstructions was accomplished within the time prescribed, and after consideration of the matter of the additional draw the company was advised by the Secretary of War, September 23, 1892, that no further action would be taken upon the proceedings already instituted requiring construction of the draw at the north channel, but that this is not intended and must not be accepted as an assurance that the company will not be required to construct a draw at the north channel hereafter should the demands of navigation require it.

On February 9, 1893, the Secretary of War accepted and approved the alterations made and work done by the company in 1889 and 1892 under the notices of 1888 and 1891 as meeting the requirements of the War Department for making navigation through the bridge reasonably free, easy, and unobstructed.

3. Bridge of the Pittsburg, Fort Wayne and Chicago Railroad Company (controlled by the Pennsylvania Railroad Company) across South Branch of Chicago River near Nineteenth street, Chicago, Ill.—This bridge has been complained of and reported upon as an unreasonable obstruction to navigation. Plans for alteration of the bridge partially meeting its objectionable features were submitted on behalf of the Pennsylvania Railroad Company January 14, 1893. The plans were approved by the Secretary of War February 11, 1893, the work to be completed by May 1, 1893, with the understanding that the alterations provided for should not be assumed as meeting the objections to the bridge; and copy of the instrument of approval was sent to Capt. W. L. Marshall, Corps of Engineers, February 15, 1893.

4. Bridge of Cumberland County, Me., across mouth of Fore River, Portland Harbor.—This bridge being an unreasonable obstruction to navigation, a notice from the Secretary of War was served upon the county February 24, 1893, requiring its alteration within one year from date of service, under the provisions of sections 4 and 5 of act of September 19, 1890 (see below, p. 474). The county commissioners submitted plans for the alterations required, which were approved by the Secretary of War April 10, 1893, the alterations to be completed by February 24, 1894; copy sent to Lieut. Col. Peter C. Hains, Corps of Engineers, April 11, 1893.

5. Bridge of the Nashville, Chattanooga and St. Louis Railway Company across Tennessee River at Johnsonville, Tenn.—Under the act of August 11, 1888, proceedings were, in 1889, instituted by the War Department for the alteration of the bridge at this point so as to render navigation unobstructed. To meet the requirements of navigation the company proposed to replace the old structure by a new bridge, and plans therefor were approved by the Secretary of War November 19, 1891, the work to be done by November 15, 1894. (See Annual Report, Chief of Engineers, 1890, p. 340, and 1892, p. 401.)

On March 10, 1893, the company submitted a modification of their plans, proposing, instead of building a new bridge, to alter the old one; the new plans were approved by the Secretary of War April 13, 1893, the work to be done and the channel cleared by November 15, 1894;

ras sent to Lieut. Col. Henry M. Robert, Corps of Engineers, 19, 1893.

Bridge of Mobile County, Ala., across Three Mile Creek.—Com- was in June, 1892, received at this office that this bridge, having w, was an obstruction to navigation. To remedy the difficulty unty commissioners submitted plans March 20, 1893, for replac- e structure with a drawbridge; approved by the Secretary of April 24, 1893; copy sent to Maj. A. N. Damrell, Corps of Engi- April 25, 1893.

Bridge of the city of Frankfort and county of Franklin, Kentucky, Kentucky River.—Under the provisions of act of September 19, notices, dated September 8, 1891, were served on the county and thorities requiring, among other alterations to render navigation the bridge free and unobstructed, that it be raised to a height of 4 inches above normal pool level. (See Annual Report, Chief gineers, 1892, p. 411.) Plans for reconstructing the city bridge clear elevation of 43 feet 4 inches (which reduced height the ary of War had authorized in the case of a neighboring bridge— ove, p. 471) were submitted May 8 and approved by the Secre- f War May 22, 1893; copy was sent to Maj. D. W. Lockwood, of Engineers, May 24, 1893.

BRIDGES OBSTRUCTING NAVIGATION.

er the requirements of sections 4 and 5 of the river and harbor proved September 19, 1890, the Secretary of War notified the s, corporations, or associations owning or controlling certain s obstructing navigation, after giving them a reasonable oppor- to be heard, to so alter said bridges as to render navigation h or under them reasonably free, easy, and unobstructed, ing in the notice the alterations required to be made, and pre- g a reasonable time in which to make them, as follows:

Bridge across Buffalo Bayou, Texas, near Houston, Tex.—Notice, September 14, 1892, served on the president of the San Antonio ransas Pass Railroad Company, October 24, 1892. Alterations ed: The construction of a line, 252 feet long, of fender piles on t bank, and one, 54 feet long, on the right bank, as indicated by d dotted lines on the attached drawing; the piles to be 5 feet between centers, to be well driven, and to be cut off at an ele- of 13 feet above the level of mean low water at the locality, and strongly connected with each other on the inner or shore side of e of piling by two lines of 6 inches by 12 inches string pieces horizontally; the lines of fender piles to be well braced by s bolted, at intervals of 10 feet, to the fender-piling and to a piles between the fender-piling and the shore; the removal of se work to the level, at least, of the tops of the fender-piles; the al of any obstructions on the channel sides of the lines of fender- that may have been placed in the bayou; and the removal, or g off, of the ends of any caps pertaining to the false work that roject into the bayou beyond the channel sides of the fender- Alterations to be made and completed on or before January 93.

alterations have been completed.

Bridge across Dickinson Bayou, Texas.—Notice, dated February 3, served on George J. Gould, president of the Galveston, Hous- d Henderson Railroad Company, February 20, 1893. Alterations

required: Remove the seventh bent from the right bank and replace that part of the bridge which now spans the space between the sixth and eighth bents from the right bank by girders or other construction so as to afford a clear width of not less than 24 feet and clear headroom of not less than 13 feet above low water for the free passage of boats, and clear from this space all piling or other obstructions to navigation that may have been placed there by the company; all as indicated on attached tracing. Alterations to be made and completed on or before May 20, 1893.

Owing to a misunderstanding in serving the notice, the work in making the alterations was delayed. The superintendent of the bridge and building department of the railroad company has acknowledged service of the notice, and promised that the alterations will be made as soon as possible.

3. "Portland Bridge," across Fore River, Portland Harbor, Maine.—Notice, dated February 20, 1893, served on the chairman of the board of county commissioners of Cumberland County, Me., February 24, 1893. Alterations required: The draw openings of the bridge to be modified so as to give a clear width of not less than 70 feet in each; the new draw to be located so that the north end will not reach beyond the existing turntable pier; the new drawpier to be set practically parallel to the existing harbor commissioner's line on the Portland City front; and the existing drawpier and other parts of the bridge not utilized in the new structure to be removed. Alterations to be made and completed on or before February 24, 1894.

In March the county commissioners submitted plans for the alterations of the bridge, which were approved by the Secretary of War, and the engineer officer in charge of the district where the bridge is located was charged with the supervision of constructing the alterations. (See above, p. 472.)

4. "Washington Bridge," across Housatonic River between Stratford and Milford, Conn.—Notice, dated February 20, 1893, served on the secretary of the joint bridge board of Fairfield and New Haven counties, Conn., March 2, 1893. Alterations required: (1) That a swing draw be constructed in the bridge at or near the middle of the river; (2) that the clear width of opening on either side of the middle or pivot pier of the draw be not less than 80 feet; (3) that the location of the center of such pivot pier be not less than 265 feet nor more than 340 feet from the east abutment of the bridge as it now stands; (4) that any parts of the existing piers, or foundations of, or riprap around the same, which lie within the draw-spans, be removed to a depth of not less than 12 feet below mean low water; (5) that the piers on either side of the draw openings be inclosed by suitable guards, piers of timber, and piles above and below, to prevent vessels striking the piers. Alterations to be made and completed on or before December 1, 1893.

The board of commissioners have decided that it will be expedient to build a new bridge, and have prepared plans for the same in compliance with the notice. Contracts for the work are about to be let.

5. Bridge across Sakonnet or Seaconnet River at Tiverton, R. I.—Notice, dated July 1, 1893, served on the president of the Old Colony Railroad Company, July 7, 1893. Alteration required: To provide the bridge with a draw having an opening of 100 feet in width in the clear. Alterations to be made and completed on or before July 1, 1894.

On the 1st of July the president of the company was advised by the Acting Secretary of War that the needs of navigation will probably soon require the opening to be deepened to twenty-five feet depth at low water, and that the piers and abutments of the span ought to be constructed accordingly.

OCCUPANCY OF AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS.

Under the requirements of section 2 of the river and harbor act approved July 5, 1884, and section 4 of the river and harbor act approved August 5, 1886, there are submitted herewith reports of officers in charge of river and harbor districts of instances in which piers, breakwaters, or other works built by the United States in aid of commerce or navigation are used, occupied, or injured by corporations or individuals. (See Appendix A A A.)

MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

MAINTENANCE AND REPAIR OF WASHINGTON AQUEDUCT—INCREASING THE WATER SUPPLY, DISTRICT OF COLUMBIA—ERECTION OF FISHWAYS AT GREAT FALLS.

Officer in charge, Col. George H. Elliot, Corps of Engineers.

1. Washington Aqueduct.—No damage has been done to the masonry dam at Great Falls during the last fiscal year, and it is in excellent condition. Some of the riprap back of the dam that was carried away by ice in previous fiscal years was not replaced during the last year, by reason of the inadequacy of the appropriation for preservation and repair and the pressure of more immediately important work. A shoal at the mouth of the feeder to the conduit at Great Falls, which interfered with the proper supply of the conduit, was removed.

The conduit between Great Falls and Wasteweir No. 2 was flushed several times during the year for the purpose of preventing further deposits; but the greater portions of the accumulations that the officer in charge found in his inspection of the interior of the conduit in 1891, and were estimated at 15,500 cubic yards, remains as at the date of the last Annual Report. An appropriation for their removal is asked for.

ERRATUM.

Annual Report of the Chief of Engineers, 1893.

Page 475, for next to last paragraph read:
An experiment that was made to find for the 9-foot conduit between the two reservoirs the value of the coefficient C in the Chezy formula, showed its value for this portion of the conduit to be 120, the crown of the conduit arch being under a pressure of about 4 feet, and the mean velocity through the conduit being 1.409 feet per second.

been in use for about thirty-five years, was refused; but he was informed that if he should make an application to have a pipe laid

through the land for carrying off the water from this weir, it would receive the consideration of the Department.

The Conduit road has been repaired during the year, and that portion of it that is between the two reservoirs is in excellent condition. The further side of Dalecarlia Hill has been graded and made ready for a macadam pavement, and about 700 feet of fencing has been done along the road near the upper reservoir. Attention has again been called to the damage to the road by the earth and clay washed down upon it from the newly excavated streets in the subdivision called Whitehaven, and it is to be hoped that the necessary steps will be taken by the proper authorities to prevent it.

The officer in charge has submitted his project for the expenditure of the $60,000 appropriated by the act of March 3, 1893, for commencing the improvement of the receiving reservoir, and it may be found in detail in his report. On account of the delicacy of the work of blasting out the drainage tunnel through Dalecarlia Hill, under the aqueduct tunnel, it will be necessary to do the work required by this project by days' work, and this, as authorized by the act, has been approved by the Secretary of War. It is hoped that the remaining $90,000 of the $150,000 contemplated by Congress as the entire cost of this work, which is so important to the District of Columbia, will be voted at its next session.

A survey and plan for carrying off the drainage from the underground valve chamber at the distributing reservoir was made during the year. The present outlet for this drainage is through a valley through private land which has recently been bought by a syndicate and laid off into streets. It is liable to be stopped up at any time by the filling up of the valley, and in case of stoppage it would cause the spring water in the ground around and above the arches (that now flows freely into the valve chambers through openings made for the purpose) to submerge the main valves and prevent the regulation of the supply of water to the city.

During the year the raising of the walls around the south connection of the upper reservoir to prevent an undue strain on the conduit in floods has been completed by placing the coping thereon; the masonry chamber for the valve on the blow-off from the by-conduit at the spillway from the same reservoir has been constructed of stone, and a traveling crane was made and put up at the influent gatehouse of the distributing reservoir for use in handling the heavy stop timbers when the monthly measurements of water consumed and wasted in the city are made, and on other occasions when the flow into the reservoir is interrupted.

The United States mains, aggregating about 21 miles in length, which lead from the distributing reservoir to the city and supply the system of street mains that were laid by and are under the care of the authorities of the District of Columbia, are in excellent condition. Three breaks, none of them serious, occurred during the year. One of them was in the old 30-inch main in New Jersey avenue. The two others were in valves connected with the 48-inch main, and were the result of the unprecedented cold weather of the last winter. At Foundry Branch the stem of the 30-inch blow-off valve was fractured while operating the valve. The renewal of this stem, which is a heavy gun-metal casting in the form of a screw and weighing about 150 pounds, required the emptying of the 30-inch and 12-inch mains between the distributing reservoir and Georgetown twice, once in order to get out the broken stem for a pattern and again to put in the new one.

The survey of the boundaries of the aqueduct lands, both in the District of Columbia and in Maryland, has been continued. By an act of Congress approved July 14, 1892, the Attorney-General, the Secretary of War, and the Engineer Commissioner of the District of Columbia were empowered to select from the lands in the District of Columbia belonging to the United States a site for a Girls' Reform School. Under the decision of the commission, a tract containing 19.39 acres, and comprising nearly the whole of the reservoir land lying between the Conduit road and the Little Falls road, was surveyed and exscinded from the reservoir lands for this purpose. The Metropolitan Southern Railroad Company selected and surveyed its route through the lands of the receiving reservoir, as authorized by the act of Congress approved March 3, 1891. The location and plans of the road were approved by the Secretary of War, and regulations concerning the work of construction and the operating of the road have been prescribed by him. The value of the lands to be occupied by the railroad company was appraised by a board of officers, as directed in the act, and the amount of the appraisement was paid by the company and deposited in the Treasury.

The roadway over Bridge No. 4 (Cabin John Bridge) was temporarily repaired by filling the holes in the asphalt pavement with broken stone and earth, but this only made the bridge passable, and the pavement of this bridge, as well as that of Bridge No. 3 (Griffith Park Bridge), is still in very bad condition. An entire renewal of the wooden superstructure of the Pennsylvania Avenue Bridge over Rock Creek has been made.

In the list of estimates of the officer in charge for the fiscal year ending June 30, 1895, will be found estimates for the remainder, $90,000, of the amount contemplated by Congress in its act approved March 3, 1893, for the improvement of the receiving reservoir, commencing the widening of the macadam pavement of the Conduit road, and raising the heights of the masonry casings of the conduit manholes.

The officer in charge renews his estimates for several necessary works, as follows: Removing the accumulation of deposits in the conduit; lowering the height of the cross dam at the distributing reservoir; protecting the inlet to the aqueduct at Great Falls; the purchase or condemnation of a site for a storage yard; cleaning out the distributing reservoir; widening and deepening the channel from the spillway at the receiving reservoir; repaving Griffith Park and Cabin John bridges; storehouse at Great Falls; protecting the conduit at Wasteweir No. 1, near Great Falls; inserting air-valves and blow-off valves in the 36-inch and 30-inch mains, and rebuilding the bridge over the channel from the spillway at the receiving reservoir.

Full explanations of the foregoing estimates, all of which have had my approval, may be found in the report of the officer in charge. This officer also suggests an important provision of law respecting appropriations for the Washington Aqueduct that is required to make them available until expended, like appropriations for river and harbor works, light-houses, etc., and not fiscal year appropriations as at present, and he states the reasons therefor, as well as for a small increase of $1,000 to the general appropriation for the preservation and repair of the aqueduct and its accessory works.

Both of these are of great importance, and the recommendations of the officer in charge in respect to them are concurred in.

July 1, 1892, balance unexpended		$2,238.51
Amount appropriated by act approved July 14, 1892		20,000.00
Amount appropriated by act approved March 3, 1893		80,000.00
		102,238.51
September 9, 1892, amount deposited with the Treasurer of the United States, being balance of appropriation of March 3, 1891	$2.49	
June 30, 1893, amount expended during fiscal year	21,431.01	
		21,433.50
July 1, 1893, balance unexpended		80,805.01
July 1, 1893, outstanding liabilities		805.01
July 1, 1893, balance available		*80,000.00

The estimates of the officer in charge for the fiscal year ending June 30, 1895, are as follows:

For completing the improvement of the receiving (or Dalecarlia) reservoir by the works required for cutting off the drainage into it of polluted water and sewerage from the surrounding country, for completing the purchase or condemnation of the small amount of land required for the purpose, and the excavation necessary at the head of the reservoir	$90,000
For commencing the widening of the macadam pavement of the Conduit road to a width of 30 feet, by widening that portion of the road that lies between the lower end of the distributing reservoir and the receiving (or Dalecarlia) reservoir; widening the road and the embankments over the culverts on the line of the aqueduct where necessary for this purpose; making the necessary changes in the drainage, and the planting of shade trees	34,500
For lowering the height of the cross dam at the distributing reservoir	12,500
For protecting the inlet to the aqueduct at Great Falls	5,000
For purchase or condemnation of a site for a storage yard	10,000
For cleaning out the distributing reservoir	13,825
For widening and deepening the channel from the spillway at the receiving (or Dalecarlia) reservoir	2,000
For repaving Griffith Park and Cabin John bridges	5,000
For storehouse at Great Falls	1,500
For protecting the conduit at Waste Weir No. 1, near Great Falls	5,000
For inserting air valves and blow-off valves in the 36-inch and 30-inch mains	6,250
For removing the accumulation of deposits in the conduit	14,000
For rebuilding the bridge over the channel from the spillway at the receiving (or Dalecarlia) reservoir	18,000
For raising the height of the masonry casings of the conduit manholes where necessary	600
For maintenance and repairs of the aqueduct, and the reservoirs, mains, roads, etc., connected therewith	21,000
Total	239,175

(See Appendix B B B 1.)

2. *Increasing the water supply of Washington, D. C.*—This work was commenced under an appropriation made in the act of Congress approved July 15, 1882.

The plan consisted of raising the dam in the Maryland channels at the Great Falls of the Potomac to an elevation of 148 feet above mean tide at the Washington navy-yard, and its extension, at that height, across Conn's Island and the Virginia channel of the river; extending the Washington Aqueduct from the distributing reservoir above Georgetown to the site selected for the new reservoir, near Howard University, by a tunnel 20,696.3 feet long; constructing at the tunnel outlet a new reservoir of about 300,000,000 gallons capacity, and con-

*$20,000 for maintenance and repair of the aqueduct; $60,000 for commencing the improvement of the receiving reservoir.

necting this reservoir by a new line of large mains with the existing system of water mains in the city of Washington.

All operations on this project are suspended, and no work has been done under it during the year.

The channel on the east side of the reservoir, which has been damaged by heavy rain, was repaired in August, and a strong bulkhead was built with a flume leading from behind it into the great sewer that passes around the reservoir. The paving of the ditch at this point was laid in cement, and it is hoped that future damage at this troublesome place will be avoided. The necessary repairs were made to the watchman's house at the reservoir during September and October. A new protection over the top of the Fayette Street air shaft was made in November. Stone was hauled, by permission, by the District of Columbia from Champlain Avenue shaft for repairs of roads.

A deed of Frederick Wetzel to the United States, for land near the distributing reservoir, dated April 26, 1890, with quitclaim deed of Margaret A. Wetzel, dated May 2, 1890, was recorded on January 18 in the land records of the District of Columbia.

The following provisions were incorporated in the act making appropriations for the District of Columbia, approved by the President March 3, 1883:

That notwithstanding the limitation prescribe by the acts of Congress, approved July fifteenth, eighteen hundred and eighty-two, and February twenty-six, eighteen hundred and eighty-five, the Secretary of War be, and he is hereby, authorized to pay to Thomas Ready the sum of four hundred and seventy dollars and ninety cents, out of the unexpended balance of the appropriation of fifty-one thousand three hundred and seventy dollars, to pay for land to extend aqueduct, made by the act entitled "An act to increase the water supply of the city of Washington, and for other purposes," approved July fifteenth, eighteen hundred and eighty-two, which sum shall be in full for the appraised value of land owned by the said Thomas Ready and taken by the United States for the requirements and purposes of that act: *Provided*, That no payment hereunder shall be made until the the Attorney-General shall have decided that an absolute title to the premises shall vest in the United States.

A watchman has been employed during the year at the new reservoir. His duties have included the guarding of the stone at the mouths of all the shafts, except the one at Foundry branch, which is under the care of the watchman at the distributing reservoir.

July 1, 1892, balance unexpended on all items of appropriation	$430,325.53
June 30, 1893, amount expended during the year	980.25
July 1, 1893, balance unexpended and available	429,345.28

No estimate for further appropriation is submitted.

(See Appendix B B B 2.)

3. Erection of fish ways at Great Falls.—At the commencement of the fiscal year no work was in progress.

Sections 4, 5, and 6 of the fish ways at Great Falls were completed at the date of the last annual report of the officer in charge, and there remained to complete the plans of the Commissioner of Fish and Fisheries sections 1, 2, and 3.

Under a ruling concerning the act of July 15, 1882, providing for the construction of these fish ways, the Secretary of War decided that the engineer officer in charge should be held responsible only for the proper protection of the Aqueduct Dam at Great Falls and the disbursement of the funds appropriated, the Commissioner of Fish and Fisheries being responsible under the act for the plans and specifications of the fish ways and their execution.

By the act of Congress approved by the President August 5, 1892, an appropriation of $15,000 was made for this work. Proposals were advertised for October 17, and the contract, which was awarded to Mr. Isaac H. Hathaway, of Philadelphia, Pa., the lowest bidder, was entered into November 23.

During August and September a surveyor and three men were employed on a survey for the purpose of enabling the Commissioner of Fish and Fisheries to make the construction plans for sections 1, 2, and 3, and also for an additional work desired by him, viz, a permanent dam between sections 1 and 2.

Upon application by the contractor, and with my authority, the time for the completion of the contract was extended one month.

Sections 2 and 3 of the fish ways and part of the permanent deflecting dam have been completed, but there remains to be done the completion of this dam and the construction of section 1.

The Commissioner of Fish and Fisheries is of the opinion that an additional sum of $7,890 will be required to complete the work, and requests that an estimate for it be submitted.

July 1, 1892, balance unexpended	$47.89
Amount appropriated by act approved August 5, 1892	15,000.00
	15,047.89
June 30, 1893, amount expended during the year	10,546.60
July 1, 1893, balance unexpended	4,501.29
July 1, 1893, outstanding liabilities	4,469.27
July 1, 1893, balance available	32.02
Amount deemed necessary by the Commissioner of Fish and Fisheries for the completion of the work	7,890.00

(See Appendix B B B 3.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS, AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT, IN THE DISTRICT OF COLUMBIA.

Officer in charge, Col. O. H. Ernst, Major, Corps of Engineers, until March 31, 1893, and since that date, Col. John M. Wilson, Lieut. Col., Corps of Engineers.

The Executive Mansion has received the usual care, and such improvements have been made as the funds available would admit.

Neufchatel mastic has been laid upon the area pavements and in a portion of the basement of the building. The heating apparatus was remodelled and improved. Some of the interior walls have been redecorated and rooms refurnished.

Those portions of the stone balustrade, coping, cornice, etc., of the building which were torn away and seriously damaged during the severe storm in November, 1891, were repaired.

New furniture, matting, carpets, etc., have been supplied from time to time when necessary.

The conservatory and greenhouses were all overhauled and repairs of various kinds made.

Every effort has been made to maintain the Washington Monument and its machinery in good condition, and to continue the improvement and ornamentation of the adjacent grounds.

All boilers and machinery have been carefully overhauled and cleaned, and the work of repainting the iron work of the interior of the monument has been commenced.

The elevator receives the most careful attention, being constantly inspected by experts, and it is believed to be as safe as it is in the power of man to make it.

There were 186,327 visitors to the top of the shaft during the year, making a total of 799,502 persons who have made the ascent since the monument was opened to the public in October, 1888.

The improvement of the monument grounds has been continued, plank walks constructed, new water pipe introduced, flower beds planted, etc.

At the propagating gardens and nurseries extensive repairs were made to the various greenhouses, about a half million plants propagated for use in the public parks, shops and storehouses repaired, and a large number of cuttings of flowering shrubs planted.

In addition to the general work performed for maintaining in good condition the improved public reservations, four small triangular spaces have been highly improved and one partially improved.

The asphalt roads and walks in Smithsonian and Judiciary parks have been extended, and repairs made to the asphalt walks in Lafayette, Franklin, Farragut, and Mount Vernon parks.

The officer in charge invites attention to the propriety of separating the office rooms of the president from those of his home and submits suggestions for consideration. He also recommends the extension of the electric light system to include the Monument grounds, Lafayette, and Franklin squares.

Attention is invited to the detailed report of the officer in charge, and to his estimates and recommendations for the fiscal year ending June 30, 1895.

His estimates are as follows:

For improvement and care of public buildings and grounds in charge of the Chief of Engineers		$206,821.40
For compensation of persons employed on public buildings and grounds		61,420.00
For replacing the overhead system of telegraph wires, with duplicate six-conductor under-ground cable, and for care and repair of existing lines		32,500.00
For contingent and incidental expenses of public buildings and grounds		500.00
For care of Washington Monument and maintenance of elevator:		
Salaries of employés	$9,060.00	
One new engine complete in position, to replace the old engine which runs the dynamo for the electric lights	650.00	
Fuel, lights, contingencies, etc	3,600.00	
		13,310.00
		314,551.40

(See Appendix C C C.)

NORTHERN AND NORTHWESTERN LAKES—SURVEYS—CORRECTING ENGRAVED PLATES—PRINTING AND ISSUING OF CHARTS.

Surveys on the Great Lakes by engineer officers were made more than two generations ago. There are upon the files of this office maps of localities made by such officers in the years 1817, 1819, 1824, 1826, 1827, and many of later dates up to the present time.

Up to 1841 these surveys were in connection with improvement of the various harbors, and of rivers tributary to the lakes. The needs of navigation demanding more than surveys of disconnected localities,

the "Survey of the Northern and Northwestern Lakes" as a connected whole was commenced under an appropriation made March 3, 1841, of $15,000 for a "hydrographic survey of the coasts of the Northern and Northwestern Lakes of the United States."

This work was naturally assigned to the War Department, as its officers had theretofore been engaged in making local surveys and had charge of the works of improvement then in progress, and had been so engaged for a number of years; and Capt. W. G. Williams, then in charge of harbor improvements on Lake Erie, with station at Buffalo, was directed by a letter of May 17, 1841, to take charge of the survey and under the appropriation made March 3, previously. A few years thereafter the office was removed to Detroit, Mich., where it remained until the field work of the survey was completed in 1882, and that place has since remained the point for the distribution of the charts of the lakes.

From 1841 the survey of the lakes was carried on under the following appropriations:

Mar. 3, 1841	$15,000	July 2, 1864	$100,000
May 18, 1842	20,000	Feb. 28, 1865	125,000
Mar. 1, 1843	30,000	June 12, 1866	50,000
June 17, 1844	20,000	Mar. 2, 1867	155,000
Mar. 3, 1845	20,000	July 20, 1868	75,000
Aug. 8, 1846	25,000	Mar. 3, 1869	100,000
Aug. 12, 1848	25,000	July 15, 1870	100,000
Mar. 3, 1849	10,000	Mar. 3, 1871	175,000
Sept. 28, 1850	25,000	June 10, 1872	175,000
Mar. 3, 1851	25,000	Mar. 3, 1873	175,000
Aug. 30, 1852	25,000	June 23, 1874	175,000
Mar. 3, 1853	50,000	Mar. 3, 1875	150,000
Aug. 5, 1854	50,000	July 31, 1876	84,000
Mar. 3, 1855	50,000	Mar. 3, 1877	94,500
Aug. 30, 1856	50,000	June 20, 1878	49,500
Mar. 3, 1857	50,000	Mar. 3, 1879	85,000
June 12, 1858	75,000	June 16, 1880	40,000
Mar. 3, 1859	75,000	Mar. 3, 1881	18,000
June 21, 1860	75,000	Aug. 7, 1882	12,000
Mar. 2, 1861	75,000		
July 5, 1862	105,000	Total	2,939,879
Feb. 9, 1863	106,879		

The field work of the survey being completed, the office of the survey was closed in August, 1882, and the records transferred to this office. The printing of the final report was completed in November, 1882. Work in connection with the engraving and printing of the charts still remained, but of the appropriation of $12,000 last above mentioned, $2,382.32 was returned to the surplus fund of the Treasury.

At that time the charts were perfected to the full needs of navigation under the then existing conditions.

From the completion of the field work to the present time the following appropriations have been made, which have been applied to printing, electrotyping and issuing charts for the use of navigators:

Mar. 3, 1883	$3,000	Aug. 30, 1890	$2,000
July 7, 1884	3,000	Mar. 3, 1891	2,000
Mar. 3, 1885	3,000	Aug. 5, 1892	2,000
Aug. 4, 1886	2,000	Mar. 3, 1893	2,000
Mar. 3, 1887	2,000		
Oct. 2, 1888	2,000	Total	25,000
Mar. 2, 1889	2,000		

To June 30, 1893, the aggregate of $7,797.80 has been turned into the Treasury from the sale of charts. Up to February 20, 1890, charts to vessels navigating the Great Lakes were, by regulation, issued free,

not to exceed one set to each vessel; charts to other parties to be sold at 30 cents each. From and after that date no more free issue was made, and charts were sold at 30 cents each, this price continuing until July 16, 1890, since which date the price has been 20 cents.

Because of the phenomenal increase of commerce on the lakes, and under the stimulus of the increased depth made practicable through the St. Marys River by the completion of the new lock and the increase of depth obtained by the improvements made in the channels of the rivers and in the harbors of the lakes, the draft of lake vessels has steadily increased, and therefore the interests of navigation have required reëxamination of certain shoaler areas sufficiently surveyed and charted for the older conditions of a 12-foot navigation.

In 1887 a vessel struck on a shoal and in 14 feet of water where 22 feet was shown. This obstruction was found to have been a detached bowlder about 6 by 4 feet on top, and this occurrence suggested the desirability of having funds available for limited surveys in such cases as this and for keeping the charts in all respects up to date. Accordingly an estimate of $10,000 was submitted with the Annual Report of 1887, which estimate was repeated for the Annual Report of 1888. An appropriation of $5,000 was made March 2, 1889, for "surveys, additions to, and correcting engraved plates." This and succeeding appropriations for the same purpose to date are as follows:

Mar. 2, 1889	$5,000	Mar. 3, 1893	$25,000
Aug. 30, 1890	10,000		
Mar. 3, 1891	10,000	Total	55,000
Aug. 5, 1892	5,000		

Under these appropriations reëxaminations have been made of various localities, as shown by the annual reports, and quite extensive reëxaminations are now under way on the St. Marys and St. Lawrence rivers.

Under the supervision of this office and during the fiscal year additions have been made to the engraved copperplates of charts of—

Lake Superior, Nos. 1 and 2.
Isle Royale, Lake Superior.
Huron Island, Lake Superior.
Grand Island, Lake Superior.
River Ste. Marie, No. 1.
East Neebish Rapids.
River Ste. Marie, No. 2.
Straits of Mackinac.
North end of Lake Michigan.
Beaver Island Group, Lake Michigan.
Coast chart No. 1, Lake Michigan.
Coast chart No. 4, Lake Michigan.
Coast chart No. 5, Lake Michigan.
Coast chart No. 8, Lake Michigan.
Coast chart No. 9, Lake Michigan.
Grand and Little Traverse Bays, Lake Michigan.
Lake Huron.
Presqu' Isle and Middle Island, Lake Huron.
Thunder Bay, Lake Huron.
Tawas Harbor, Lake Huron.
Sand Beach, harbor of refuge, Lake Huron.
South end of Lake Huron.
St. Clair River.
Lake St. Clair.
Detroit River.
Lake Erie.
Coast chart No. 1, Lake Erie.
Coast chart No. 5, Lake Erie.
Coast chart No. 6, Lake Erie.
Coast chart No. 7, Lake Erie.
Sandusky Bay.
Niagara Falls.
Lake Ontario.
Coast chart No. 1, Lake Ontario.
Coast chart No. 3, Lake Ontario.
Coast chart No. 4, Lake Ontario.
St. Lawrence River, Nos. 1, 2, 3, 4, 5, and 6.

New electrotypes of the following plates have been made:

Straits of Mackinac.
North end of Lake Michigan.
Beaver Island group, Lake Michigan.
Lake Huron.

During the year 6,757 charts were distributed under the supervision of Col. O. M. Poe, Corps of Engineers, at Detroit, Mich. Of these 6,347 were sold at 20 cents each, 18 at 10 cents each, 5 at 5 cents each, and 5 at 4 cents each. In addition 12 charts were sold from this office at

[illegible] W. L. Marshall, Corps [illegible] The total amount re- [illegible] which has been turned [illegible] printing and distribut- [illegible] for the fact that the [illegible] for river and har- [illegible] could not be printed and dis- [illegible]

[illegible] Poe additions were made to the [illegible]

[illegible]	Coast chart, No. 7, Lake Erie.
[illegible]	Detroit River, No. 50.
[illegible]	Lake Michigan coast chart, No. 8.
[illegible]	Lake Michigan coast chart, No. 9.
[illegible]	Saginaw River.
[illegible]	

During the fiscal year surveys were made as follows:

St. Marys River, from White Fish Bay to Detour light-house.—This survey is executed under the supervision of Col. O. M. Poe, Corps of Engineers. Under an allotment of $4,000, afterwards increased to $4,325, work was commenced in January, 1893. This allotment was so small that the work was confined to the requisite astronomical determinations and to the extension of the triangulation. At the close of the fiscal year a field observatory had been constructed at Sault Ste. Marie, Mich., observations had been completed for the determination of latitude, and observations were in progress for the determination of longitude. Eight primary triangulation stations had been definitely, and four approximately, selected. Six triangulation stations had been built, and from twelve to fifteen lines of sight cut. Preparations had been made for active field work after July 1, 1893. The estimated cost of the resurvey of St. Marys River is $64,080, of which $40,000 can be profitably expended during the fiscal year ending June 30, 1895.

(See Appendix D D D 1.)

Seneca Shoal, Lake Erie.—This shoal, located S. 15° 36′ W., and distant 6¼ miles from the Buffalo Breakwater Light, was struck by the steamer *Seneca*, of the Lehigh Valley line, and a survey was at once ordered, and was made under the direction of Maj. E. H. Ruffner, Corps of Engineers. This shoal, with 15 feet of water upon it at ordinary lake level, is now shown on the charts.

Discharges of Niagara River.—A report upon the measurements made appears in Appendix D D D 2 to this report.

Resurvey of the lake front at Chicago.—This survey, made under the direction of Capt. W. L. Marshall, Corps of Engineers, has been completed, and a preliminary map, showing the obstructions, etc., and the sailing lines to avoid them has been issued, and is for sale at Col. Poe's office, in Detroit, and at Capt. Marshall's office, in Chicago.

(See Appendix D D D 3.)

Shoal at the mouth of the Niagara River.—Report reached this office in July, 1893, that a steam barge grounded on this shoal, the water being reported 11 feet deep, although on the coast chart it is marked 13-feet shoal. A survey was accordingly ordered, and was made under the direction of Capt. Dan. C. Kingman, Corps of Engineers.

The examination showed that the shoal was properly located on the charts, and with the present stage of the lake level to which the chart is drawn. The lowest [illegible] when the barge grounded was [illegible]

The report appears in Appendix D D D 4 to this report.

Surveys in the St. Lawrence River.—A reëxamination of the hydrography to discover obstructions at greater depth than that heretofore demanded by navigation being determined upon, it has been decided to sweep the channels with a horizontal bar carried at the designated depth. The work is carried on under the direction of Capt. Smith S. Leach, Corps of Engineers. Preliminary to the actual survey, a careful examination has been made of the original notes and sheets of the former survey, and the work will now progress under an allotment from the funds available for the fiscal year ending June 30, 1894.

Continual effort has been made to keep the charts up to date, and a very considerable number have been corrected during the year, and the special examinations made in connection with river and harbor work have been made use of whenever available. If it were not for this collateral assistance a number of very important charts would, owing to lack of funds to make surveys, be in a very imperfect, and, in some cases, useless condition.

As soon as the funds available will permit it is proposed to prepare and publish general charts of lakes Superior and Michigan, each on one sheet, there being a great demand for these charts at present; also to prepare and publish coast charts of lakes Huron and Superior in order to complete the set of charts of the lakes.

These projects or something of a similar nature will have to be carried out if the charts are to be rendered of the greatest service to navigators. The work already done, particularly the location of the dangerous shoals in Lake Erie, has fully demonstrated the necessity which exists for work of this character. The lake marine is of too great importance to the country at large for any effort looking toward its safety to be spared. When the Government sells charts to navigators these charts should embody the latest and most accurate information concerning the localities to which they refer, and everything should be done to render navigation safe and certain.

The low water of recent years, combined with the great increase in size and number of vessels, has resulted in the larger and more expensive vessels discovering dangers previously unknown, and discovering them by the costly process of striking them. All dangers so discovered should at once be surveyed and located upon the charts, in order to prevent the repetition of similar accidents at the same point. Localities deemed perfectly safe for navigation when smaller vessels were used are now regarded with suspicion by the larger vessels, and it is essential that certain special areas should be reëxamined.

St. Marys River is one of the localities on the lakes where new surveys are essential in order that the charts may be rendered of the greatest service; the surveys upon which the present charts are based were made between 1853 and 1857, and since that time the region tributary to the river has undergone an enormous development. More than 9,000,000 tons of freight now pass through the river annually, and extensive works of improvement have been completed and are in progress. Since the original surveys were made the draft of vessels has increased from 9½ and 12 feet to 16 feet and will shortly be increased to 20 feet. The river is a difficult one to navigate with the large vessels of the present time, and new charts are absolutely essential. The records of the former survey and of the river improvement will prevent all duplication of work, and will permit the survey to be pushed to completion as quickly as possible.

The organized districts in connection with river and harbor work now established at the chief cities on the lakes will greatly facilitate

keeping all of the charts up to date, and will insure the maximum results with the minimum cost.

In view of the great importance of this work to the lake marine an appropriation of $50,000 for surveys and other expenses connected with correcting and extending the charts of the northern and northwestern lakes is most earnestly recommended, as the conditions now existing are urgent and require that this amount should be available at the earliest possible moment, and an appropriation of $3,000 is recommended for the printing and distribution of the charts.

Attention is invited to the fact that it is estimated that it will require $40,000 to complete the survey of the St. Marys River. The great and growing commerce on this highway demands an early completion of the work. The officer in charge reports that this sum can all be profitably expended during the fiscal year if made available. The extension of the charts to include general charts of lakes Superior and Michigan, of coast charts for lakes Superior and Huron, and surveys at other localities will absorb the balance of the estimated amount for the fiscal year of 1894. Again, the work during a fiscal year in that latitude is interrupted by the inclement season of about five months' duration in the middle of the fiscal year. It would be an actual economy and saving to have the funds appropriated made available until expended, in which event arrangements could be made to organize the field work to commence in the spring and to continue uninterruptedly until the close of the season. As matters now are, work must be organized so as to cease absolutely on June 30; then, if an appropriation be made after that date, only to be available for the fiscal year, the work can not be effectively organized for operations for the remainder of the season, and effective work can only begin in the ensuing spring, to be again interrupted on June 30.

Annual water levels of the Northern and Northwestern Lakes.—Tables showing the monthly means of water levels from July 1, 1892, to June 30, 1893, at Charlotte and Oswego, Lake Ontario; at Erie and Cleveland, Lake Erie; at Milwaukee, Lake Michigan; and at Escanaba, Green Bay (no observations being made at this latter place from December 17, 1892, to April 26, 1893), being in continuation of those published in the Annual Report of the Chief of Engineers for 1892, will be found in Appendix D D D 5.

In the publication of water levels heretofore the readings of the gauge at Ogdensburg, on the St. Lawrence River, have not been given. Considering the increasing commerce on that river and to that port, this record of gauge readings has become important, and accordingly the readings from 1869 to 1874 and from 1883 to 1892, inclusive, so far as the same have been recorded, with the exception of the year 1888, are given in Appendix D D D 6.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES IN YELLOWSTONE NATIONAL PARK.

Officer in charge, Maj. William A. Jones, Corps of Engineers, with Lieut. Hiram M. Chittenden, Corps of Engineers, under his immediate orders until March 28, 1893; Division Engineer, Col. O. M. Poe, Corps of Engineers.

The construction of roads and bridges in Yellowstone National Park was commenced in a systematic manner in 1883, when the direction of the work was placed in the hands of an officer of the Corps of Engineers. A number of small appropriations had been expended in the endeavor to make it possible to reach the main objects of interest; access was

rendered possible, but only after a tiresome trip, attended with considerable danger. Since 1883 the work has remained in the charge of the Engineer Department.

At the outset the engineers adopted a project which has since been followed. It embraces a belt-line road, commencing at Gardiner, on the north boundary line of the Park; thence to Mammoth Hot Springs; thence to Upper Geyser Basin via Norris Geyser and Lower Geyser basins; thence to the outlet of Yellowstone Lake via Shoshone Lake and the west arm of Yellowstone Lake, crossing the Continental Divide of the Rocky Mountains twice; thence to Yancey via the Falls and Grand Canyon of the Yellowstone River; thence to Mammoth Hot Springs, completing a circuit of about 145 miles. There are also included in the project a road from the west boundary line of the Park to intersect the road along the Yellowstone River, between the lake outlet and the Falls, via Lower Geyser Basin; a road from Norris Geyser Basin to the Falls of the Yellowstone; a road from Yancey to the east line of the Park, and short branch roads to points of interest, comprising in all about 225 miles of new roads, with necessary bridges and culverts. Estimated costs, as revised in 1889, $444,779.42.

The act of Congress approved March 3, 1891, changed the project of that part of the belt line between Lower Geyser Basin and Yellowstone Lake by requiring the road to be built "by the shortest practicable route" from Fountain Geyser to the Thumb of Yellowstone Lake. This change did not materially affect the cost.

The act of Congress approved August 5, 1892, appropriated $45,000 and provided—

> That fifteen thousand dollars of this amount, or so much thereof as may be necessary, may be expended, in the discretion of the Secretary of War, for the construction of a road from the Upper Geyser Basin to a point on Snake River where it crosses the southern boundary of the Park.

This act has been construed as the wish of Congress to modify the project by adding about 33½ miles of roads, which will considerably increase the estimated cost made in 1889. Experience has proven the estimate to have been too low, even for the original project. The officer in charge proposes at an early date to submit an estimate for the completion of the project as amended by the acts of Congress. The officer also calls attention to the fact that about 20 per cent of the appropriations thus far made have been expended in repairs and should not be charged to the cost of constructing new roads. At the beginning of the year 116 miles of roads had been opened to travel, though their construction is not yet completed. These roads enabled tourists to visit Mammoth Hot Springs, Norris Geyser Basin, Lower Geyser Basin, Upper Geyser Basin, Yellowstone Lake, the Falls, and upper end of the Grand Canyon of the Yellowstone River. Total amount expended upon the project since commencement of work in 1883 to June 30, 1892, including outstanding liabilities, $334,779.42.

During the past year the bulk of the work has been in repair and improving the construction of existing roads. Short stretches of new roads were built to avoid excessive grades in old roads at Norris and Canyon Creek Hills. The construction of a new road 1 mile long was commenced at the Upper Falls of the Yellowstone, to replace an equal length of old road. The road to Inspiration Point was extended half a mile. Repairs were made from Mammoth Hot Springs to Cook City, at Virginia Cascade, on Blanden Hill, and in Gibbon and Grand canyons.

Six substantial bridges were constructed, of an average span of 40 feet; two over Gibbon River, three over the Firehole above Upper Basin, and one small bridge across a tributary of the latter river.

At the end of the year the project was nearly one-half completed.

Amount expended during fiscal year ending June 30, 1893, including outstanding liabilities, $39,000.

July 1, 1892, balance unexpended		$94.92
Amount appropriated by act approved August 5, 1892		45,000.00
Amount appropriated by act approved March 3, 1893		30,000.00
		75,094.92
June 30, 1893, amount expended during fiscal year		36,284.46
July 1, 1893, balance unexpended		38,810.46
July 1, 1893, outstanding liabilities	$2,810.46	
July 1, 1893, amount covered by uncompleted contracts	6,000.00	
		8,810.46
July 1, 1893, balance available		30,000.00
Amount (estimated) required for completion of existing project		*130,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		†150,000.00

(See Appendix E E E)

MILITARY AND OTHER MAPS.

The following maps and plans have been photolithographed and an edition printed:

Map of that portion of the Department of the Platte and adjacent territory east of the one hundred and third meridian.

Map of a portion of Southeastern Arizona.

Outline map of the lake front, Chicago, Ill., from Chicago Harbor to Indiana State line, No. 3.

Detail drawings of Lock and Dam No. 2, Great Kanawha River, West Virginia, in twelve sheets.

Map of modification in the pierhead line for the west shore of Arthur Kill, New Jersey, from Smith street, Perth Amboy, north to Ploughshare Point.

Map of modification in the pierhead and bulkhead line around Rikers Island, East River, New York.

Map of modification in the pierhead and bulkhead line for the easterly shore of East River at Ravenswood, Queens County, N. Y.

RECONNAISSANCES AND EXPLORATIONS.

The following officers have been on duty at the headquarters of the military departments engaged in preparing such maps and making such surveys as were required by their respective commanding officers:

Lieut. Cassius E. Gillette, Corps of Engineers, at headquarters Department of the Missouri.

Maj. Tully McCrea, Fifth U. S. Artillery, at headquarters Department of the Columbia.

Capt. Charles A. Worden, Seventh U. S. Infantry, at headquarters Department of the Platte.

Lieut. Charles G. Lyman, Second U. S. Cavalry, at headquarters Department of California.

Lieut. Cassius E. Gillette, Corps of Engineers, engineer officer, Department of the Missouri, reports that the rifle range at Fort Sheridan, Idaho, was resurveyed and levels were taken for the purpose of improving the grade of the range; that the office work has consisted in the

*According to estimate made in 1889, which was too low.

†$20,000 for repairs and maintenance and $130,000 for construction of new roads.

preparation of maps and tracings of original drawings and sketches, mounting and correcting maps, and furnishing blue prints for the ceremonies connected with the dedication of the World's Fair Grounds in October, 1892. (See Appendix F F F 1.)

Maj. Tully McCrea, Fifth U. S. Artillery, acting engineer officer, Department of the Columbia, reports that field operations have consisted of surveying and marking the lines of the public land survey through the Vancouver Barracks Military Reservation; maps, plans, tracings, and blue prints have been made and issued and the military maps of the department kept up to date by the addition of all available topographical information. (See Appendix F F F 2.)

Capt. Charles A. Worden, Seventh U. S. Infantry, acting engineer officer, Department of the Platte, reports that in August, 1892, he visited Fort Sidney and marked out 20 acres on the military reservation to be used by the city of Sidney, Nebr., as a cemetery, in accordance with the act of Congress of June 10, 1892; that the map of the department and adjacent territory east of the one hundred and third meridian was completed, reproduced, and published, and about 150 copies distributed; that work has been continued on the revision of the map of the western portion of the department; and that numerous maps have been mounted on cloth, tracings and blue prints made, and note books, instruments, and drawings supplied to the various posts in the department. (See Appendix F F F 3.)

Lieut. Charles G. Lyman, Second U. S. Cavalry, in charge of engineer office, Department of California, reports that the office work involved the preparation of original drawings, tracing, and blue print of maps, etc., coloring, mounting, and distribution of maps, the care and preservation of surveying and astronomical instruments in store, and issuing the same to the different posts, to troops in the field, and to the quartermaster's department. No field work of any importance has been entered into during the year. (See Appendix F F F 4.)

ESTIMATES FOR AMOUNTS REQUIRED FOR SURVEYS AND RECONNAISSANCES IN MILITARY DEPARTMENTS, AND FOR MAPS, INCLUSIVE OF WAR MAPS.

For military surveys and reconnaissances and surveys of military reservations by the engineer officers attached to the several headquarters of military departments, being an average of $2,142.86 for each of seven military departments west of the Mississippi River, $15,000; for publication of maps for use of the War Department, inclusive of war maps, $10,000; total, $25,000.

Attention is specially invited to this estimate for appropriation and to the important uses for which it is intended.

At the headquarters of the military departments west of the Mississippi River there are stationed officers of the Corps of Engineers, or other officers detailed to act, whose duty it is to make reconnaissances for military purposes, to make such surveys and prepare such maps as may be required by their respective commanding officers. In recent years no appropriations have been made for these purposes, and, consequently these officers have been very much cramped for lack of the necessary means, and the usefulness of their offices has been very much reduced in consequence. The maps of these departments are constantly in need of revision and additions, which the officers make so far as possible, but with no means even for the purchase of paper their efforts are limited in results.

Paragraph 383 of the Army Regulations requires that the command-

ing officer of each post where there are fixed batteries bearing upon a channel will call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. Calls upon this department to perform its duty under this regulation can not be honored from lack of means.

Interest in the war maps published by this office and republished by virtue of the sundry civil act of March 2, 1889, continues very active. Of the 1,100 copies of each map printed under the act alluded to, all those not printed in this office (47 sheets) have been exhausted for sometime, and the calls for them can only be honored with sets deficient in that number of sheets.

Besides all this, there is much information in this office relative to military geography which could with little expense be made available for the information of officers of the Army; for instance, there are on the office files detailed maps of regions of Europe which may become at an early day the theaters of war, and it would be of great advantage to the service if such information as these maps give could be made available for the study of officers, especially on the outbreak of hostilities. Were the means provided, this office would be glad to compile and to disseminate the information on its files.

It is the policy of this country to keep a standing army small in numbers, but it is its expectation that it should be a highly instructed one, and a small outlay as here referred to will be conducive to that end.

Applications from officers of the Army have been received for maps of certain regions of Europe, and it was with great regret that this office could not render this assistance to officers desirous of improving themselves professionally, especially when the material was on its files.

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1893, the following-named officers were in charge of the several divisions of the office of the Chief of Engineers:

FIRST DIVISION.—*Fortifications and Surveys relating thereto—Armament of Fortifications—Sites for Engineer Defenses—Boards of Engineers for Defenses—Military Reservations—Land files—Public Buildings and Grounds—Washington Aqueduct—Roads and Bridges in Yellowstone National Park.*

SECOND DIVISION.—*Battalion of Engineers—United States Engineer School and Engineer Depot and Post—Professional Papers and Information—Personnel—Orders.*

Capt. John G. D. Knight.

THIRD DIVISION.—*Improvement of Rivers and Harbors and Surveys relating thereto—Bridging Navigable Waters of the United States—The removal of Wrecks Obstructing Navigation.*

Maj. Henry M. Adams.

FOURTH DIVISION.—*Accounts for Disbursements—Contracts—Returns of Engineer Property and Instruments—Application for Remittances—Appropriations and Estimates—Blank Forms.*

FIFTH DIVISION.—*Survey of the Lakes—Explorations and Surveys—Reconnaissances—Maps—Instruments—Claims.*

Maj. Thomas Turtle.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. DANIEL S. LAMONT,
Secretary of War.

STATEMENT SHOWING THE RANK AND THE DUTIES OF OFFICERS OF THE CORPS OF ENGINEERS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

RANK AND NAME.	DUTIES.
BRIGADIER-GENERAL AND CHIEF OF ENGINEERS.	
Thos. Lincoln Casey....	In command of the Corps of Engineers and in charge of The Engineer Department. Charged with the supervision of such matters connected with construction of jetties and other works at South Pass, Mississippi River, as require the action of the Secretary of War. In charge of the construction of the building for Library of Congress by virtue of act of Congress approved October 2, 1888. Member of Rock Creek Park Commission by virtue of act of Congress approved September 27, 1890. Member of commission on suburban highways, District of Columbia, by virtue of act of Congress approved March 2, 1893.
COLONELS.	
George H. Mendell.....	Division engineer of the Pacific division. Member of The Board of Engineers when it is acting upon matters pertaining to the defensive works of the Pacific coast. In charge of the defensive works at Fort Winfield Scott and at Fort Mason, in San Francisco Bay, and of the Battery at San Diego, Cal. In charge of construction of gun and mortar batteries for defense of San Francisco, Cal. In charge of the improvement of Oakland Harbor, Cal. In charge of examination of entrance to harbor of San Francisco, known as Golden Gate, Cal. To act as a judge of the character of the earth discovered by borings being made by the Treasury Department at San Francisco, Cal. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of San Francisco Harbor and adjacent waters, Cal.; at Port Townsend, Port Angeles, Anacortes, Aberdeen, Ocosta, Ballard, Seattle, Edmonds, Sidney, Hoquiam, South Bend, Tacoma, Steilacoom, Blaine, Cosmopolis, Ilwaco, La Conner, Shelton, Marysville, and Snohomish, Wash., and at Flavel, Oregon; upon the change in the project for the improvement of the harbor at Humboldt Bay, Cal.; and upon the improvement of the mouth of Columbia River; of board of engineers upon the obstructions in the Columbia River between Three Mile Rapids and Celilo Falls; and of the California Débris Commission to regulate hydraulic mining in the State of California.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
COLONELS. (continued.)	
Henry L. Abbot..... *Bvt. Brig. General.*	Division engineer of the northeast division. Member and president of The Board of Engineers. Member of Board of Ordnance and Fortification. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; and at Oswego, N. Y.; and to test the working of the mechanism of a 12-inch gun-lift; and of board of officers for the examination for promotion of such officers of the Corps of Engineers as may be ordered before it. Member of court of inquiry convened at Washington on January 5, 1893.
William P. Craighill.....	Division engineer of the southeast division. In charge of the defensive works at forts Carroll and McHenry, Baltimore, Md. In charge of the improvement of the harbor at Baltimore, Md.; of Patapsco River, Baltimore Harbor, Md.; James River, Va.; and Gauly, Great Kanawha, and Elk rivers, W. Va. In charge of examinations of South and Middle branches of Patapsco River, Baltimore, Md. In charge of removal of wreck of schooner *Pinafore*, Baltimore Harbor. To exercise supervision over construction of two bridges across Gauley River, W. Va. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; and of the port of Philadelphia; and upon the proposed deep-water harbor at San Pedro or Santa Monica bays.
Cyrus B. Comstock..... *Bvt. Brig. General.*	Division engineer of the southwest division. Member of The Board of Engineers. Member of board of visitors for U. S. Engineer School. Member and president of the Mississippi River Commission created by act of Congress approved June 28, 1879. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; and of the port of Philadelphia; and upon improving the channel of the Ohio River at Logstown Bar; and of board of officers for the examination for promotion of such officers of the Corps of Engineers as may be ordered before it. Representative of the War Department at the Fifth Congress of Internal Navigation in Paris, France, July 18–August 5, 1892.
Orlando M. Poe..... *Bvt. Brig. General.*	Division engineer of the northwest division. In charge of the defensive works at Fort Wayne, Mich. In charge of the improvement of the harbors at Cheboygan, Au Sable, and at Thunder Bay; harbor of refuge at Sand Beach; of the St. Marys River, at the Falls; of the St. Clair Flats Ship Canal; and of the rivers Detroit, Saginaw, Clinton, and Rouge, Thunder Bay River, Alpena, Black River at Port Huron, and mouth of Black River, Mich., and Hay Lake Channel of the St. Marys River; of the ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo; the construction of dry dock, St. Marys Falls Canal; of turning basin in Rouge River, and of dredging at Grosse Pointe Channel. In charge of St. Clair Flats Ship Canal and St. Marys Falls Canal, Mich. In charge of issuing charts of northern and northwestern lakes, and of water-level observations on Lake Huron. In charge of survey of shoal off Littles Point and of shoal off Pelée Spit Light, Lake Erie; and of examinations of Pine River at St. Clair City; Belle River, Marine City, from its mouth to Broadway Street Bridge; Hammond Bay,

tatement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
COLONELS. (continued.)	
rlando M. Poe *Brt. Brig. General.*	Lake Huron, at the mouth of Ocqueoc River, and Sebewaing River, Saginaw Bay, Mich. Member of boards of engineer officers to consider and report upon the subject of harbor lines at Detroit, Mich.; and to investigate the subject of raft-towing on the Great Lakes and their connecting waters. Engineer Ninth and Eleventh Light-House districts, temporarily.
avid C. Houston.....	Member of The Board of Engineers. In charge of the defensive works at Fort Griswold, Trumbull, and Hale, Conn.; Columbus, Wood. Wadsworth, and Tompkins and its batteries, Castle Williams, South Battery, at Governors Island, of sea wall at same, and of sea wall at Davids Island, N. Y. In charge of construction of gun batteries on Staten Island for defense of New York. In charge of the improvement of the harbors of Clinton, New Haven, Bridgeport, Black Rock, Norwalk, Five Mile River, Wilsons Point, Stamford, Cos Cob, and Miamus River, Conn., and Greenport, Port Chester, Glen Cove, Echo Harbor, Flushing Bay, Port Jefferson Inlet, Larchmont, and Huntington, N. Y.; of the Harbor of Refuge, Duck Island Harbor; and the construction of breakwaters at New Haven, Conn. In charge of the improvement of Housatonic River and for breakwater, Thames River, including Shaws Cove, New London Harbor, Mystic and Saugatuck rivers, Conn., Connecticut River, Mass. and Conn., and East Chester Creek, Patchogue River, and Browns Creek, N. Y. In charge of examinations of Norwalk Harbor, Westport Harbor, Conn.; Berrians Creek; and Southold Harbor, Long Island, N. Y. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; of Stamford Harbor; at Norwalk, and at Bridgeport, Conn.; and of board of officers for the examination for promotion of such officers of the Corps of Engineers as may be ordered before it. Member of board of visitors for U. S. Engineer School. His death at New York City, May 18, 1893, announced in General Orders No. 5, Headquarters, Corps of Engineers, May 26, 1893.
orge H. Elliot.....	In charge of the Washington Aqueduct; increasing water supply of the city of Washington, and of the disbursement of the funds pertaining to the erection of fish ways at Great Falls of the Potomac. Member of board of engineer officers to fix the damages for the use and occupation of the right of way granted to the Metropolitan Southern Railroad Company through the property of the United States in Montgomery County, Md. Member of the Light House-Board.
IEUTENANT-COLONELS.	
mry M. Robert.....	In charge of the improvement of the rivers Tennessee, above Chattanooga, Tenn., and below Bee Tree Shoals, Cumberland above and below Nashville, Ky. and Tenn., Hiawassee, Caney Fork, French Broad, Little Pigeon, Clinch, and Obion, Tenn., and South Fork of the Cumberland, Ky. In charge of examinations of Ohio River between Livingston Point and the head of Tennessee Island, Ky.; Sequatchie and Duck rivers; Hiawassee River from its confluence with the Tennessee River to the mouth of the Ocoee River; and Emory River from

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	
Henry M. Robert	its mouth to Harriman, Tenn. To exercise supervision over the construction of bridges across the Tennessee River at Knoxville; at or near Knoxville; and at Johnsonville, Tenn. Member of board of engineer officers to consider and report upon the proposed deep-water harbor at San Pedro or Santa Monico bays. Member of The Board of Engineers. In charge of the defensive works at Forts Griswold and Trumbull, Conn.; Columbus, Wood, Wadsworth, and Tompkins and its batteries, Castle Williams, South Battery, at Governors Island, of sea wall at same, and of sea wall at Davids Island, N. Y. In charge of construction of gun batteries on Staten Island for defense of New York. In charge of the improvement of the harbors of Clinton, New Haven, Bridgeport, Black Rock, Norwalk, Five Mile River, Wilsons Point, Stamford, Cos Cob, and Miamus River, Conn., and Greenport, Port Chester, Glen Cove, Flushing Bay, Port Jefferson Inlet, Larchmont, and Huntington, N. Y.; of the harbor of refuge, Duck Island Harbor; and the construction of breakwaters at New Haven, Conn. In charge of the improvement of the Housatonic River and for breakwater, Thames River, including Shaws Cove, New London Harbor, Mystic and Saugatuck rivers, Conn., Connecticut River, Mass. and Conn., and East Chester Creek, Patchogue River, and Browns Creek, N. Y. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; and of Stamford Harbor, Conn. Member of board of visitors for U. S. Engineer School.
John M. Wilson *Brt. Colonel. Ex-officio, Colonel of Engineers.*	Detached; Superintendent of the U. S. Military Academy. In charge of Public Buildings and Grounds in the District of Columbia, with the rank of colonel. In charge of the preservation, care, and safety of buildings occupied by the War Department in the District of Columbia. In charge of the erection of a monument at the birthplace of Washington and the construction of an iron pile dock as a means of approach to the same. Member of the Light-House Board.
John W. Barlow	Detached; member and disbursing officer of the International Boundary Commission for the location and marking of the boundary between the United States and Mexico, under the direction of the Secretary of State.
Peter C. Hains	In charge of the defensive works at forts Knox, Popham, Gorges, Scammel, Preble, and McClary, batteries at Portland Head, and Gerrishs Island, Me., and at Fort Constitution and Jerrys Point, N. H. In charge of the improvement of the harbors at Belfast, Camden, Rockland, Portland, and York, and Back Cove, Portland Harbor, Me., harbor of refuge at Little Harbor, N. H., and the construction of breakwater from Mount Desert to Porcupine Island, Me. In charge of the improvement of the rivers Penobscot, Kennebunk, Saco, Narraguagus, Bagaduce, Kennebec, Harrasceket, and St. Croix, Me.; Cocheco and Bellamy, N. H.; Lubec Channel and Moosea-bec Bar, Me. In charge of examinations of the harbors of Rockland, Tennants, Carver, Owl Head, Frenchs Beach, Lincolnville, and Portland; Vinal Haven; South Fork of Bagaduce River; Georges River, and channel near Hardys Point below Pembroke, Me. In charge of removal of wreck of schooner *Isabel Alberto* in Rockland

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	
Peter C. Hains.....	Harbor; and of part of wreck of schooner *Huntress* off Browneys Island, Me. To exercise supervision over the alteration of bridge across Narraguagus River at Milbridge, and the alterations in the "Portland Bridge" across the mouth of Fore River, Portland Harbor, Me. Member of board of engineer officers to consider and report upon the proposed deep-water harbor at San Pedro or Santa Monica bays.
George L. Gillespie.....	Member of The Board of Engineers. In charge of the defensive works at forts Hamilton and Lafayette, N. Y., and fort at Sandy Hook, N. J. In charge of construction of gun and mortar batteries for defense of New York. In charge of the improvement of the harbors of New York, Rondout, and Saugerties, N. Y., and Raritan Bay, N. J. In charge of the improvement of the Hudson and Harlem rivers, N. Y.; Bay Ridge Channel, Gowanus Bay channels, Buttermilk Channel, and Jamaica Bay; deepening Gedney's Channel, Newtown Creek and Bay, and Wappingers Creek, N. Y. In charge of the removal of obstructions in East River and Hell Gate, N. Y. In charge of examinations at Fort Pond Bay, and for channel west of Robbins Reef light-house to connect the mouth of Arthur Kill with New York Harbor, N. Y. In charge of removal of wrecks of schooner *Wild Pigeon* in New York Harbor and of a canal boat in Bronx River, N. Y. To exercise supervision over construction of proposed bridge across the East River between the city of New York and Long Island, and of two bridges between the cities of New York and Brooklyn; of bridges across Harlem River at Third avenue, at Fourth avenue, at One hundred and fifty-fifth street, and at the Broadway crossing, New York City; across Hudson River in and between the city of New York and the State of New Jersey; across Dutch Kills Creek; and across Bronx River below West Farms, N. Y.; of temporary bridges across Harlem River at Third avenue, at Fourth avenue, and at One hundred and fifty-sixth street, New York City, of certain work of the Hudson Tunnel Railway Company, and of two piers on the Jersey Flats, New York Bay, at Bayonne, N. J. Member of board of visitors for U. S. Engineer School. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of New York Harbor and its adjacent waters; of Stamford Harbor; at Norwalk, and at Bridgeport, Conn.; and to test the woking of the mechanism of a 12-inch gun lift.
Charles R. Suter.....	Member of the Mississippi River Commission created by act of Congress approved June 28, 1879. Member and president of the Missouri River Commission created by act of Congress approved July 5, 1884. To exercise supervision over the construction of two bridges across the Missouri River at or near Sioux City, Iowa; and of bridges opposite to or within the corporate limits of Nebraska City, Nebr.; at or near Nebraska City, Nebr.; at Omaha, Nebr.; between Omaha, Nebr., and Council Bluffs, Iowa; near Council Bluffs, Iowa, and East Omaha, Nebr.; between Kansas City and Sibley, Mo.; between Leavenworth, Kans., and Platte County, Mo.; between Wyandotte County, Kans., and Clay County, Mo.; between Clay and Jackson counties; at St. Charles; between St. Charles and the mouth of Missouri River, Mo., and near Quindaro, Kans. In charge of examination of

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS (continued.)	
Charles R. Suter.....	Kansas River, Kans. Member of board of engineers to consider and report upon the obstructions in the Columbia River between Three Mile Rapids and Celilo Falls. Engineer fifteenth and sixteenth light-house districts.
Jered A. Smith.....	In charge of the improvement of harbors at Monroe, Mich., Toledo, Port Clinton, Sandusky, Vermillion, Huron, Cleveland, Fairport, Ashtabula, Conneaut, and mouth of Black River, and of Sandusky River, Ohio. In charge of water-level observations on Lake Erie. In charge of removal of wrecks of steamtug *Wilcox* and of sailboat *Rescue* in Port Clinton Harbor, Ohio. To supervise the construction of bridges across Sandusky Bay, and across Huron River at Huron, Ohio. Engineer Tenth Light-House District.
Samuel M. Mansfield....	In charge of the defensive works at forts Warren, Winthrop, Standish, Andrew, Independence, and on Long Island Head, Mass. In charge of construction of gun and mortar batteries for defense of Boston Harbor. In charge of the improvement of the harbors at Newburyport, Lynn, Boston (including sea walls on Point Allerton, Great Brewster Island, Lovells Island, Gallops Island, Long Island Head, Rainsford Island, and Deer Island; Mystic and Charles rivers; Fort Point Channel; channel leading to Nantasket Beach and main ship channel), Provincetown, Plymouth, Scituate, Hingham, Gloucester, Winthrop, Wellfleet, Manchester, Kingston, Salem, including South River, and Stage Harbor at Chatham, Mass. In charge of construction of a harbor of refuge at Sandy Bay, Cape Ann, Mass. In charge of the improvement of the Merrimac River at Mitchells Falls, Ipswich, Powow, Weymouth, Mystic, Malden, and Essex rivers, Mass. In charge of examinations of Vincent Cove, Gloucester Harbor; Gloucester, from Five Pound Island to head of river; Neponsit River; East Boston Channel, from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad to the channel at Jeffries Point, and Chelsea River, from Grand Junction Railroad Bridge to the Boston and Maine, eastern division, Railroad Bridge; and of Saugu River, Mass. To supervise the rebuilding of Market Street and Arsenal Street bridges; the alterations in bridges across Charles River, and the construction of a temporary bridge across Mystic River at Boston, Mass.
William R. King.....	Commanding Post and U. S. Engineer School at Willets Point, N. Y., and the battalion of engineers. In charge of the defensive works at Fort Schuyler and Willets Point; of the engineer depot at Willets Point; torpedoes for harbor defense, and experiments with the same. In charge of construction of gun and mortar batteries for defense of New York at eastern entrance of harbor. In charge of funds pertaining to the library of the U. S. Engineer School. Member of board of engineers to consider and report upon the obstructions in the Columbia River between Three Mile Rapids and Celilo Falls.
Wm. H. H. Benyaurd ...	In charge of the defensive works of Alcatraz and Angel islands, and at Lime Point, Cal. In charge of Yerba Buena Island, San Francisco Harbor, Cal. In charge of the improvement of the harbors at Wilmington, San Diego, and San Luis Obispo; of Napa River and Redwood Creek, Cal., and Colorado River, Ariz. In charge

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	
Wm. H. H. Benyaurd...	of examinations of Navigable Slough, San Francisco Bay, and Alviso Slough, Cal. To exercise supervision over the construction of bridge across Napa River at Third street, Napa City, Cal. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of San Francisco Harbor and adjacent waters and upon the change in the project for the improvement of the harbor at Humboldt Bay, Cal.; and of the California Débris Commission to regulate hydraulic mining in the State of California.
Garrett J. Lydecker....	In charge of the Louisville and Portland Canal. In charge of the improvement of the Falls of the Ohio River, the Indiana Chute Fall, Ohio River, Wabash River, Ind., and Ill., and White River, Ind. In charge of examination of Little Wabash and Embarras rivers, Ill. To exercise supervision over the construction of bridges across the Ohio River at Louisville; and across Salt River near West Point, Ky.
Amos Stickney.....	In charge of the improvement of the Ohio River, Monongahela and Cheat rivers, W. Va., Allegheny River, Pa., and of the Muskingum River, Ohio; the construction of harbor of refuge at mouth of Muskingum River, of a dam at Herrs Island, and of a movable dam at or below the mouth of Beaver River, Pa.; and of operating snag boats on the Ohio River. In charge of examination and survey of the mouths of Crawfish and Mill creeks, in Cincinnati, Ohio; and of examinations of harbor at Evansville, Ind.; Ohio River at or near Elizabethtown, Ill.; Ohio River between Ludlow and Covington, Ky., and Cincinnati, Ohio; Ohio River between Ironton, Ohio, and 3 miles along and up the Ohio east of the mouth of Guyan River, W. Va.; Allegheny River, from Olean, N. Y., to Warren, Pa.; Little Miami River; Raccoon River from its junction with the Ohio River for 50 miles, Ohio; for lock and dam on Allegheny River, at or near Tarentum; for lock and dam on Allegheny River, between the dam at Tarentum and Herr Island Dam; and for the location of movable locks and dams on the Ohio River, between Davis Island Dam and the dams at or near the mouth of Beaver River, Pa. To exercise supervision over the construction of bridges across Ohio River near Ceredo, W. Va., and between Covington, Ky., and Cincinnati, Ohio; over Muskingum River at Zanesville, and above the mouth of Brush Creek, Ohio; over the Allegheny River at Pittsburg and at Oil City; over the Monongahela River at Pittsburg, near Pittsburg, at Elizabeth, and between Pittsburg and Homestead; over Youghiogheny River at Boston and in Fayette County; across Cheat River at Point Marion, Pa.; and across Licking River, between Newport and Covington, Ky.; and the rebuilding of bridge across Ohio River from Cincinnati, Ohio, to Newport, Ky. Member of boards of engineer officers to consider and report upon the subject of harbor lines at Pittsburg, Pa., and on the Ohio to Davis Island Dam; on both sides of the Ohio River from the upper end of Martins Ferry to the lower end of the city of Bellaire, Ohio; and at Cincinnati, including the Licking River, between its mouth and the bridge of the Louisville and Nashville Railroad; upon a project for the construction of a navigable pass through the Sandy

Statement showing the stations and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS—continued.	
Amos Stickney.....	Lake Dam; and for improving the channel of the Ohio River at Logstown Bar. Engineer Fourteenth Light-House District.
MAJORS.	
Alexander Mackenzie...	Member of the Missouri River Commission created by act of Congress approved July 5, 1884. In charge of the improvement of the Mississippi River from the mouth of the Missouri to Minneapolis, and at Rock Island and Des Moines Rapids; and of Quincy Bay, Ill. In charge of operating the dry dock at the Des Moines Rapids Canal; the Des Moines Rapids Canal and snag boats and dredge boats on Upper Mississippi River. In charge of examinations of Mississippi River at and near Bellevue; Mississippi River, Iowa side, from mouth of Iowa River to Burlington, Iowa; Hamburg Bay, on the Mississippi River; harbor at Moline, Ill.; and Lake Pepin, for harbors of refuge, Wis. To supervise the construction of bridges across the Mississippi River at Muscatine, at Lyons, at or near Clinton, Iowa; at La Crosse, Wis.; at St. Paul; and from Winona, Minn., to the opposite shore in Wisconsin. Member of boards of engineer officers to consider and report upon a project for the construction of a navigable pass through the Sandy Lake Dam; and for improving the channel of the Ohio River at Logstown Bar.
Oswald H. Ernst..... *Ex-officio. Colonel of Engineers.*	Member of the Mississippi River Commission created by act of Congress approved June 28, 1879. Member of the Missouri River Commission created by act of Congress approved July 5, 1884. In charge of Public Buildings and Grounds in the District of Columbia, with the rank of colonel. In charge of the care and maintenance of the Washington Monument. In charge of the erection of a monument to mark the birthplace of George Washington. Member of boards of engineer officers to fix the damages for the use and occupation of the right of way granted to the Metropolitan Southern Railroad Company through the property of the United States in Montgomery County, Md.; and to consider and report upon a project for improving the channel of the Ohio River at Logstown Bar. Member of the Light-House Board. Detached; Superintendent of the U. S. Military Academy.
David P. Heap.....	Detached; engineer Third Light-House District.
William Ludlow..... *Brt. Lieut. Colonel.*	In charge of the defensive works at Fort Wayne, Mich. In charge of the improvement of the harbors at Michigan City, Ind.; St. Joseph, including Benton Harbor Canal; South Haven, Saugatuck, Holland (Black Lake), Grand Haven, Muskegon, White Lake, Pentwater, Ludington, Manistee, Frankfort, Charlevoix, including entrance to Pine Lake; Petoskey, Cheboygan, Au Sable and Thunder Bay, and harbors of refuge at Portage Lake and Sand Beach, Mich. In charge of the improvement of St. Joseph and Saginaw rivers; Thunder Bay River, Alpena; Black River at Port Huron, mouth of Black River, Clinton and Rouge rivers; and the construction of turning basin in Rouge River, Mich. In charge of examinations of Pine River at St. Clair City; Belle River, Marine City, from its mouth to Broadway Street Bridge; Hammond Bay, Lake Huron, at the mouth of Oqueoc River, and Sebewaing River, Saginaw Bay, Mich. To supervise the construction of bridges across Rouge River near Detroit;

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
William Ludlow *Bvt. Lieut. Colonel.*	across Muskegon Lake between Muskegon and North Muskegon; and across Muskegon River at Muskegon, Mich. Member of board of engineer officers to consider and report upon the subject of harbor lines at Detroit, Mich.
William A. Jones.....	In charge of the improvement of the Chippewa River, including Yellow Banks; of the Minnesota and St. Croix rivers, the Red River of the North, and of the Mississippi River above the Falls of St. Anthony. In charge of the construction and improvement of roads and bridges in Yellowstone National Park. In charge of the care and maintenance of reservoirs at head waters of the Mississippi River, including construction of a navigable pass through the Sandy Lake Dam. In charge of gauging the waters of the Mississippi River and its tributaries at or near St. Paul, Minn. To exercise supervision over construction of bridges across Red River of the North at Alpha, De Mers, and Minnesota avenues, Grand Forks, N. Dak.; and across Chippewa River near Red Cedar, Wis.
Andrew N. Damrell....	In charge of the defensive works at forts Morgan and Gaines, Ala., and fort on Ship Island, Miss. In charge of the improvement of the harbors at Mobile, Ala., and Biloxi, Miss. In charge of the improvement of the rivers Warrior and Black Warrior, Tombigbee and Warrior, Ala.; Tombigbee, Ala. and Miss.; Pascagoula, Pearl, Noxubee, Chickasahay, and Leaf, Miss., and Bogue Chitto, La. In charge of examinations of Mississippi Sound, outside of the range of islands off the Mississippi coast; Biloxi Bay, known as Back Bay, north of Biloxi and up to Hansboro; Pearl River near Jackson; Pearl River, Edinburg to Lake Burnside; bar at mouth of Wolf River; bar at mouth of Jordan River; and channel at mouth of Old Fort Bayou, Miss. In charge of the removal of wreck of sunken dry dock in Mobile River, Ala. To supervise the construction of bridge across Fort Bayou at Ocean Springs, Miss.; and the rebuilding of bridge across Three Mile Creek, Ala.
Charles J. Allen.....	In charge of the improvement of the entrance to Galveston Harbor and of the harbor at Brazos Santiago, Tex. In charge of the improvement of ship channel in Galveston Bay, the channel in West Galveston Bay, Buffalo Bayou, Trinity River, and Cedar Bayou, Tex. In charge of examination of Brazos River, from its mouth to Richmond, Tex. To exercise supervision over the construction of bridges across West Bay, from Galveston Island to Virginia Point; across Chocolate and Bastrop; Dickinson, and White Oak bayous, Tex. In charge of the improvements of the Mississippi River—removal of snags, etc.; Mississippi River from the mouth of the Ohio River to the mouth of the Missouri River, and harbor at St. Louis, Mo., Osage River, Mo. and Kans., Gasconade River, Mo., and Kaskaskia River, Ill. To exercise supervision over the construction of bridges across the Mississippi River at St. Louis, Mo., and at Alton, Ill. Member and disbursing officer of board of engineers to consider and report upon the obstructions in the Columbia River between Three Mile Rapids and Celilo Falls.
Charles W. Raymond...	In charge of the defensive works at Fort Mifflin, Pa.; Fort Delaware, and Fort opposite Fort Delaware, Del.; at Finns Point, and site for defenses at Red Bank, N. J.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
Charles W. Raymond...	In charge of the improvement of the harbor at Philadelphia, Pa. and N. J., and Delaware Breakwater, Del.; ice harbors at Marcus Hook, Pa., and the head of Delaware Bay, Del.; of the Schuylkill River, Pa.; Delaware River, from Trenton to its mouth, Rancocas, Maurice, and Salem rivers; and Alloway and Goshen creeks, N. J.; and of the construction of pier near Lewes, Del. In charge of examinations of Cooper and Dennis creeks, and Barnegat Inlet, entrance and harbor, N. J. In charge of removal of wrecks of steamer *Gandaloup* and steam tug *Starlight* in Barnegat Inlet; of ship *Gentemunde* and steamer *Florida*, lying off Abecon Beach, N. J.; of the bark *Felix* in Schuylkill River near Point Breeze; of canal boat *Francis J. Henry* in Cooper Creek; of schooner *Marcia S. Lewis* in Great Egg Harbor Inlet, N. J.; of schooner *Annie S. Gaskill* and of barge *McClellan*, near entrance to Delaware Bay; of the schooner *Booth Brothers* off Brigantine Shoal, N. J.; and of canal boat *General Grant* in Delaware River opposite Bridesburg, Pa. To supervise construction of bridge across Frankford Creek at Philadelphia Pa. In charge of disbursement of funds appropriated for the Trenton Battle Monument. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of the port of Philadelphia, and upon the proposed deep-water harbor at San Pedro or Santa Monica bays; and of board to consider and report upon the conditions of sale and price to be fixed for land in the vicinity of Fort Mifflin, Pa.
L. Cooper Overman....	On leave of absence until September 20, 1892. His resignation as major, Corps of Engineers, accepted by the President, to take effect September 20, 1892.
Alexander M. Miller....	In charge of the improvement of the Mississippi River—removal of snags, etc.; Mississippi River from the mouth of the Ohio River to the mouth of the Missouri River, and harbor at St. Louis, Mo., Osage River, Mo. and Kans., Gasconade River, Mo., and Kaskaskia River, Ill. To exercise supervision over the construction of bridges across the Mississippi River at St. Louis, Mo., and at Alton, Ill. In charge of the improvement of the entrance to Galveston Harbor and of the harbor at Brazos, Santiago, Tex. In charge of the improvement of ship channel in Galveston Bay, the channel in West Galveston Bay, Buffalo Bayou, Trinity River, and Cedar Bayou, Tex. To exercise supervision over the construction of bridges across West Bay, from Galveston Island to Virginia Point; across Chocolate and Bastrop; Dickinson, and White Oak bayous, Tex.
Milton B. Adams.....	In charge of the defensive works at Fort Montgomery, N. Y. In charge of the improvement of the harbors at Ogdensburg and Plattsburg, N. Y., and Burlington, Vt., and construction of breakwater at Rouses Point, N. Y. In charge of the improvement of St. Lawrence, Ticonderoga, and Great Chazy rivers; of narrows at Lake Champlain, N. Y., and of Otter Creek, Vt. In charge of examinations of harbor at Adams Landing on Grand Isle, and North Hero Harbor, Lake Champlain, Vt. Member of board of officers to select and substantially mark a site on the military reservation at Fort Montgomery, N. Y., for a pest house to be erected thereon by the village of Rouses Point. Detached; engineer Ninth and Eleventh Light-House districts.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
Wm. R. Livermore.....	Detached; engineer First and Second Light-House districts.
William H. Heuer.....	In charge of the improvement of Humboldt Harbor and Bay, Cal. In charge of the improvement of the Sacramento and Feather rivers, including treatment of the Yuba River near and above Marysville, San Joaquin and Mokelumne rivers, and Petaluma Creek, Cal. In charge of examinations of Old River Branch of San Joaquin River; San Joaquin River from Hills Ferry to Firebaughs Ferry, including closing of sloughs on the river above Stockton; Merced River; mouth of Navarro River; Tuolumne River; harbor of Crescent City; Stanislaus River, Cal., and harbor at Yaquina Bay, Oreg. To exercise supervision over the construction of bridges across San Joaquin River near Grayson, and at Garwood Ferry Crossing; across Sacramento River at Butte City; and across Mokelumne River, Cal. Member of boards of engineer officers to consider and report upon the subject of the harbor lines of San Francisco Harbor and adjacent waters, and upon the change in the project for the improvement of the harbor at Humboldt Bay, Cal.; and upon the improvement of the mouth of the Columbia River; and of the California Débris Commission to regulate hydraulic mining in the State of California. Engineer Twelfth Light-House District.
William S. Stanton.....	In charge of the defensive works at forts Macon and Caswell, N. C. In charge of the improvement of the harbors at Beaufort, N. C., Georgetown, and Winyaw Bay, S. C. In charge of the improvement of Staunton River, Va.; Cape Fear River above and below Wilmington, Roanoke, Neuse, Pamlico, Tar, Yadkin, Black, Trent, New, North East (Cape Fear), Lockwoods Folly, and Pasquotank rivers, Contentnia, Mackeys, and Fishing creeks, Ocracoke Inlet, and inland waterway from Newberne to Beaufort, inland waterway between Beaufort Harbor and New River, and waterway between New River and Swansboro, N. C. In charge of examinations for breakwater to protect town of Beaufort; Potohunk River; and Durhams Estuary, from mouth to Edwards Mills, N. C. In charge of removal of wreck of steamer *I. D. Coleman* in Albemarle Sound; of the remains of the wreck of the steamer *Concord* in Pamlico River near Washington; of the wreck of steamer *City of Long Branch* in Roanoke River; and of the remains of the wreck of a gunboat at the mouth of Cape Fear River, N. C. To exercise supervision over the construction of bridges across the Cape Fear River at Fayetteville, and across Tar River at Tarboro, N. C.
Thomas H. Handbury...	In charge of the defensive works at forts Stevens, Oregon, and Canby, Wash. In charge of the improvement of the canal at the Cascades of the Columbia River, mouth of the Columbia River, Willamette River at and above Portland, including the removal of obstructions in Yamhill River up to McMinnville; Lower Willamette and Columbia rivers, in front of and below Portland, Youngs and Klaskuine rivers, Oregon, and Columbia River, between the mouth of the Willamette River and the city of Vancouver, and of the Cowlitz River, Wash. In charge of examinations of Yamhill River, from mouth to McMinnville; Willamette River, above Oregon City, Oregon; and Lewis River, from its mouth to Speliah Creek, Wash. In charge of water gauges on the Columbia River from Astoria to the bar. To supervise the construction of two

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
Thomas H. Handbury...	bridges across the Willamette River at Portland, Oregon, and of bridges across the Willamette River opposite Albany; across the Yamhill River near La Fayette; across the Walluski River, Clatsop County, Oregon; across the Columbia River near Vancouver, and across the Cowlitz River at Toledo, Wash. Member of boards of engineer officers to consider and report upon the subject of harbor lines at Port Townsend, Port Angeles, Anacortes, Aberdeen, Ocosta, Ballard, Seattle, Edmonds, Sidney, Hoquiam, South Bend, Tacoma, Steilacoom, Blaine, Cosmopolis, Ilwaco, and La Conner, Shelton, Marysville, and Snohomish, Wash., and at Flavel, Oregon; upon the improvement of the mouth of Columbia River; and upon the proposed deep-water harbor at San Pedro and Santa Monica bays. Engineer Thirteenth Light-House District.
James C. Post.....	Detached; military attaché to the United States legation at London. To represent the War Department at the International Maritime Congress, to be held in London in July, 1893.
James F. Gregory.....	In charge of the improvement of the harbors at Manistique and Cedar River, Mich.; Menomonee, Oconto, Pensaukee, Ahnapee, Kewaunee, Two Rivers, Manitowoc, Sheboygan, Port Washington, Milwaukee, Racine, and Kenosha, and Green Bay, including the Fox River below De Pere, Wis., and Waukegan, Ill. In charge of harbors of refuge at Milwaukee Bay, and at Sturgeon Bay Canal, Wis., and of water communications across Keweenaw Point, Lake Superior, Mich. In charge of the Sturgeon Bay and Lake Michigan Ship Canal. In charge of the improvement of Menominee River, Wis., and Mich., south outlet of Lake Winnebago, Fox River, including the harbor of Fond du Lac and approaches thereto; and removing sand bar at outlet of Fond du Lac River, Wis. In charge of examinations of Green Bay, from light-house to first bridge on Fox River; Stockbridge and Calumet harbors, Lake Winnebago; and Fox River, for protection wall on the canal at Kaukauna, Wis. In charge of water-level observations on Lake Michigan. In charge of removal of part of the wreck of schooner *Lumberman* off Wind Point, Lake Michigan. To supervise the construction of bridges across the Sheboygan River at Sheboygan; across Portage Canal near Portage City; across Fox River at Oshkosh, and the Government canal at De Pere; across Manitowoc River at Manitowoc; across Wolf River at New London; across Kewaunee River at Kewaunee (two); across Kinnickinnic River, and across Milwaukee River at Milwaukee, Wis.
Henry M. Adams.....	In charge of the third division, Office of the Chief of Engineers. Member of the Light-House Board.
Chas. E. L. B. Davis....	In charge of the defensive works at forts Foote and Washington, Md., Wool and Monroe, Va. In charge of the improvement of the Potomac River in the vicinity of Washington, and of channel in the Eastern Branch, Potomac River. In charge of the improvement of Patuxent River, Md., of the rivers Rappahannock, Mattaponi, York, and Pamunkey, and of Nomini, Urbana, Occoquan, Aquia, and Lower Machodoc creeks, Va. In charge of examinations of mouth of Parish Creek, Wicomico River, Md., Milford Haven, Morattico Creek, and Little Wicomico River, Va.; and of the piers of the Aqueduct Bridge, Potomac River. In charge of the construction

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
has. E. L. B. Davis....	of the sewerage system at Fort Monroe, Va. To supervise the reconstruction of the Washington shore end of the "Long Bridge" at Washington, D. C.; the construction of bridges across Potomac River at "The Three Sisters," D. C.; across Patuxent River at Mount Calvert, Md., and across Hunting Creek, and of a street railway, and a bridge across Mill Creek, at Fort Monroe, Va. Member of boards of engineer officers to fix the damages for the use and occupation of the right of way granted to the Metropolitan Southern Railroad Company through the property of the United States in Montgomery County, Md., and to investigate the subject of raft-towing on the Great Lakes and their connecting waters.
ames B. Quinn.....	In charge of the defensive works at Forts Jackson, St. Philip, Livingston, Pike, and Macomb, Tower Dupré, Battery Bienvenue, and Tower at Proctorsville, La. In charge of the improvement of the Amite River and Bayou Manchac, Tickfaw, Tchefuncte, and Bogue Falia rivers, Mermentau River and tributaries, mouth and passes of Calcasieu River, bayous Terrebonne, Courtableau, Teche, from mouth to St. Martinsville, La Fourche and Plaquemine, including removing obstructions from Grand River and Pigeon bayous; channel, bay, and passes of Bayou Vermillion, La.; harbor at Sabine Pass and Neches River, Tex.; and Sabine River, La. and Tex. In charge of examinations for harbor of refuge on Lake Pontchartrain; bayous Black and Terrebonne, with a view of connecting them; Homochitto River, from its mouth to the Louisville, New Orleans and Texas Railroad Bridge, Miss.; channel through Sabine Lake from Sabine Pass to mouths of Sabine and Neches rivers; Sabine River, from Sudduths Bluff to Logansport, La.; and from the mouth of Neches River to Shooks Bluff, Tex. In charge of removal of the wrecks of two coal barges in Bayou Teche, La. To report upon the depth and width of a channel secured and maintained by jetties at the mouth of the Mississippi River. To supervise the construction of two bridges across Bayou La Fourche, La. Engineer Seventh and Eighth Light-House districts.
aniel W. Lockwood...	In charge of the improvement of Little Kanawha, Guyandotte, and Buckhannon rivers, W. Va., Tug Fork of Big Sandy River, Big Sandy River, near Louisa, for movable dam, Kentucky, Tradewater, Green, and Barren rivers; Levisa Fork of Big Sandy River, Rough River, and of Licking River from Farmers to West Liberty, Ky. In charge of examinations of Licking River, and of Big Sandy River from its junction with the Ohio River to the crossing of the Big Sandy by the Chesapeake and Ohio Railroad Bridge, Ky. In charge of removal of wreck of stone barge in Kentucky River at Frankfort, Ky. To exercise supervision over the construction of two bridges across the Tug Fork of the Big Sandy River above Catlettsburg; the rebuilding of bridge across Big Sandy River; the rebuilding of bridge, and the alterations of bridge across the Kentucky River at Frankfort, Ky. Member of boards of engineer officers to consider and report upon the subject of harbor lines at Pittsburg, Pa., and on the Ohio to Davis Island Dam; on both sides of the Ohio River from the upper end of Martins Ferry to the lower end of the city of Bellaire, Ohio; and at

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (Continued.)	
Daniel W. Lockwood...	Cincinnati, including the Licking River between its mouth and the bridge of the Louisville and Nashville Railroad.
Ernest H. Ruffner.....	In charge of the improvement of the harbors at Erie, Pa., and Buffalo, Wilson, Olcott, Oak Orchard, and Dunkirk, N. Y. In charge of improvement of Tonawanda Harbor and Niagara River, and of Niagara River from Tonawanda to Port Day, N. Y. In charge of examination of Dunkirk Harbor, N. Y. In charge of measurement of the discharge of Niagara River. Member of board of engineer officers to consider and report upon the subject of harbor lines at Oswego, N. Y.
John C. Mallery.....	In charge of the defensive works at forts Marion and Taylor, Fla. In charge of the improvement of the harbors at Key West, including entrance thereto, Tampa Bay, Cedar Keys, and St. Augustine, Fla. In charge of the improvement of the St. Johns River, Volusia Bar, Caloosahatchee, Manatee, Withlacoochee, Suwanee, and Pease rivers, channel of Charlotte Harbor and Pease Creek, Ocklawaha River, Indian River between Goat Creek and Jupiter Inlet, and Sarasota Bay, Fla. In charge of examination of harbor at Cape Canaveral, Fla. To exercise supervision over the construction of bridges across St. Johns River at Buffalo Bluff, and at the Lake Monroe crossing, Fla. On sick leave of absence.
Clinton B. Sears.....	Commanding Company A, Battalion of Engineers. Instructor in submarine mining at the U. S. Engineer School. In charge of the improvement of the harbors of Duluth, Grand Marais, Agate Bay, Minn.; Superior Bay on Lake Superior, St. Louis Bay, and Ashland, Wis.; Ontonagon, Eagle Harbor, and Marquette; harbor of refuge at Grand Marais; of water communication across Keweenaw Point, Lake Superior, Mich.; and of Minnesota Point at Superior, Wis. In charge of examination of Allouez Bay and Nemadji River, at Superior, Wis. In charge of water-level observations on Lake Superior. To exercise supervision over construction of two bridges across the St. Louis River between the States of Minnesota and Wisconsin. Member of board of engineer officers to investigate the subject of raft-towing on the Great Lakes and their connecting waters.
Thomas Turtle	In charge of the fourth and fifth divisions, Office of the Chief of Engineers. Disbursing officer, Office of the Chief of Engineers. Member of the United States Board on Geographic Names.
CAPTAINS.	
Edward Maguire.....	Detached; engineer Fourth Light-House District. His death at Philadelphia, Pa., October 11, 1892, announced in General Orders No. 8, Headquarters, Corps of Engineers, October 13, 1892.
Frederick A. Mahan....	Detached; engineer secretary of the Light-House Board.
Charles F. Powell.....	In charge of the improvement of the Missouri River from the Great Falls, Mont., to Sioux City, Iowa, including removing snags and other like obstructions above Sioux City; and of the Yellowstone River, Mont. and N. Dak. In charge of survey of Missouri River between Sioux City, Iowa, and Fort Benton, Mont.; and of examinations of Missouri River from Three Forks to Canyon Ferry, Mont., and of James River, S. Dak. Detached; Engineer

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	
Charles F. Powell.....	Commissioner of the District of Columbia. Member of Rock Creek Park Commission by virtue of act of Congress approved September 27, 1890.
John G. D. Knight.....	In charge of the first and second divisions, Office of the Chief of Engineers. Member of boards of officers to test range and position finders; to examine certain buildings and rooms tendered for the temporary use of the Record and Pension Office of the War Department, and to examine the buildings in Washington now occupied by the War Department; and to consider the subject of printing, and to recommend any amendments to paragraphs 616 and 901 of the Regulations, as may be advisable.
Richard L. Hoxie.....	Commanding Company B, Battalion of Engineers. Instructor in military engineering at the U. S. Engineer School. Member of general courts-martial convened at Willets Point, N. Y., March 24 and September 21, 1892.
William L. Marshall....	In charge of the improvement of the harbors at Chicago and Calumet, Ill.; of the improvement of the Illinois and Calumet rivers; and of the construction of the Illinois and Mississippi Canal. In charge of examinations of Wolf River Harbor, Lake Michigan, Ind., and outer harbor at mouth of Calumet River, Ill. To supervise the construction of bridges across the south branch of the Chicago River at South Halstead street; across west fork of south branch of Chicago River at Chicago; across Chicago River in West Chicago; and across the Illinois River at Kampsville or Columbiana, and at Havana; and the alterations of the bridge across south branch of Chicago River near Nineteenth street, Chicago, Ill. Member of board of officers on World's Columbian Exposition, and of board of engineer officers to consider and report upon a project for the construction of a navigable pass through the Sandy Lake Dam.
Joseph H. Willard.....	In charge of the improvement of Tensas River and Bayou Macon, La; Ouachita and Black rivers, including the harbor at Camden; and Bayou Bartholomew in La. and Ark.; Bœuf River and Bayou D'Arbonne, including improvement of the Cornie, La.; bayous Rondeway and Vidal, La.; Cypress Bayou, La. and Tex.; Red River, La. and Ark.; Red River above the Atchafalaya River, Ark.; Forked Deer River and North Fork of same, and the Big Hatchie River, Tenn.; of the rivers Big Sunflower, Yazoo, Big Black, and Tallahatchie, Tchula Lake, Steele's and Washington bayous, and mouth of Yazoo River, Miss. In charge of survey of Red River from Fulton, Ark., to the Atchafalaya River, La., and Cypress Bayou, and the lakes between Jefferson, Tex., and Shreveport, La.; and of examinations of Little River; Ouachita River, above Camden, Ark.; Cassidys Bayou, Cold Water River, Miss.; and Sulphur River from its mouth to Sulphur Station, Tex. In charge of the water gauges on the Lower Mississippi River and its principal tributaries. To supervise the construction of the bridges across the Tensas River at Clayton's Plantation; across Little River; across Bœuf River near Rayville; across Red River at Upper Falls near Alexandria; across Ouachita River near Columbia, La.; and across Big Black River at Baldwin's Ferry; and to supervise changes and alterations in the bridge across Big Black River at Allen's Station, Miss.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAIN: continued.	
Henry A. Allen	In charge of the defensive works at Forts McRee, Pickens, and Barrancas, Fla. In charge of the improvement of the harbors at Apalachicola Bay and River, and at Pensacola, Fla. In charge of the improvement of the rivers Coosa and Chattahoochee, Ga. and Ala.; Flint, Ga.; Choctawhatchee, Escambia, and Conecuh, Fla. and Ala.; Apalachicola River, including Lee's Slough and its connection with the Chipola River, and from said connection to the mouth of Chipola River, Fla.; Alabama, Canana, and Tallapoosa, Ala.; and La Grange Bayou, improving Holmes River, Fla. In charge of examinations of the bar at the junction of Choctawhatchee Bay and Santa Rosa Sound; and bar at the mouth of Alaqua Bayou, at its entrance into Choctawhatchee Bay, Fla. To supervise the construction of bridge across the Alabama River near Montgomery, Ala.
Carl F. Palfrey	Secretary and disbursing officer of the Mississippi River Commission, created by act of Congress approved June 28, 1879. Secretary and assistant to the construction Committee of the Mississippi River Commission and disbursing officer for works carried on by the Commission.
William H. Bixby	In charge of the defensive works of forts at Clarks Point, Mass., Dutch Island, and Fort Adams, R. I. In charge of the improvement of the harbors of Wareham, Hyannis, New Bedford, Vineyard Haven, Marthas Vineyard, inner harbor, and Westport, Mass.; Newport, Block Island, and Greenwich Bay, R. I., and Stonington, Conn.; harbor of refuge at Nantucket, and Canapitsit Channel, Mass.; cove near Coasters Harbor Island, and waterway between said island and Rhode Island, entrance to Point Judith Pond, west of Point Judith, and construction of harbor of refuge at Point Judith, R. I. In charge of the improvement of the rivers Taunton, Mass.; Pawtucket, and Pawcatuck; and Providence River and Narragansett Bay, and creek, Jacket Shoal, Providence River, R. I. In charge of examinations of Stonington Harbor and the entrance thereto, Conn.; New Bedford Harbor; Woods Holl; Tarpaulin Cove, Naushon Island, for a breakwater, Mass.; Lloyds Harbor, Cow Bay; Wickford Harbor, Narragansett Bay; breachway into Salt Pond, Block Island; creek, Which Harbor, Greenwich Bay; Pawtuxet Harbor, Providence River; and inner harbor at Point Judith, breakwater, R. I. In charge of removal of wrecks of schooners *Benna J. Fellows* and *J. B. Woodbury* in Chatham Bay, Cape Cod, Mass.; of schooner *Laura Locker* in Point Judith Harbor, R. I.; of steam yacht *Alva* and barge *Sunbeam* in Pollock Rip Channel; of barge *Storm King* near Pollock Rip; of bark *E. S. Allen* and schooner *Lavinia Post* in Nantucket Sound; of schooner *Francis Lewis* in New Bedford Harbor; of schooner *George S. Terrell* in Vineyard Sound; of an old wreck in Edgartown Harbor; the remains of an old wreck from entrance to Nantucket Harbor; of the schooner *Nellie V. Jones*; the remains of an old schooner and of schooner *Lizzie* off Monomoy Point, Cape Cod, Mass. To supervise the construction of bridges at Osterville, and across Cotuit Narrows, Mass.
Henry S. Taber	In charge of the improvement of the Arkansas River, including removing obstructions and operating snag boats, Arkansas and Indian Territory; and of rivers White, St. Francis, Little Red, Petit Jean, and Cache, Ark.; Black,

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	
Henry S. Taber.....	Mo. and Ark.; Little and St Francis, Mo., and of removal of rock shoals in Fourche River, Ark. In charge of examinations of Fourche Le Fevre and Current River, and of Saline River, Ark. In charge of removal of wreck of steamer *John Matthews* in Arkansas River. To supervise the construction of bridges across the Poteau River in the Choctaw Nation, near Fort Smith; and across the Arkansas River at Cummings Landing, Ark.
Eric Bergland.....	Detached; engineer Fifth and Sixth Light-House districts.
William T. Rossell.....	Detached; Engineer Commissioner of the District of Columbia. Member of Rock Creek Park Commission by virtue of act of Congress approved September 27, 1890. On leave of absence.
Thomas W. Symons.....	In charge of the improvement of harbor at Yaquina Bay, entrance to harbor at Nehalem Bay, mouth of Siuslaw River, Umpqua and Coquille rivers, Tillamook Bay, entrance and harbor at Coos Bay, and Upper Coquille River between Coquille City and Myrtle Point, Oregon; the Upper Columbia and Snake rivers, Oregon, and Wash.; Upper Snake River between Huntington Bridge and Seven Devils mining district, Idaho; Olympia Harbor, Grays Harbor and Chehalis River; the Columbia River from the head of Rock Island Rapids to the foot of Priest Rapids; Puget Sound and its tributary waters; Swinomish Slough, Nasel River, and Willapa River and Harbor, Wash. In charge of examinations of Kootenai River from Fry, Idaho, to international boundary line; Spokane River, from Post Falls to Lake Cœur d'Alene, Idaho; Chetco River; inner navigation of Alsea River; Nestucca River, as far as Woods; Rogue River, from Grant Pass to the mouth; navigable tide-water channels of Coos River, Oregon; Snohomish River from mouth to Lowell; Nooksack River; Everett Harbor, including mouth of Snohomish River; and Upper Columbia River, from the international boundary to Rock Island Rapids, Wash. To exercise supervision over the construction of bridges across Clearwater River above Lewiston, Idaho; across D'Wamish River near Seattle; across Snohomish River (three); across Chehalis River; across Swinomish Slough; across the south arm of Willapa River; across Skagit River at Mount Vernon; across Nooksack River at Ferndale, and at Lynden; across South Bay, Elk River, between Bay City and Laidlaw; and across Columbia River between Douglas and Kittitas counties, Wash. Member of board of engineer officers to consider and report upon the subject of harbor lines at Port Townsend, Port Angeles, Anacortes, Aberdeen, Ocosta, Ballard, Seattle, Edmonds, Sidney, Hoquiam, South Bend, Taconma, Steilacoom, Blaine, Cosmopolis, Ilwaco, La Conner, Shelton, Marysville, and Snohomish, Wash., and at Flavel, Oregon.
Smith S. Leach.....	On duty under the immediate orders of Lieut. Col. Mansfield upon the fortifications of Boston Harbor; in charge of the defensive works at Fort Montgomery, N. Y.; in charge of the improvement of the harbors at Ogdensburg and Plattsburg, N. Y., and Burlington, Vt., and construction of breakwater at Rouses Point, N. Y.; in charge of the improvement of St. Lawrence, Ticonderoga, and Great Chazy rivers; of narrows at Lake Champlain, N. Y., and of Otter Creek, Vt.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	
Dan C. Kingman.....	In charge of the defensive works at Forts Niagara and Ontario, N. Y.; in charge of the improvement of the harbors at Charlotte, Great Sodus Bay, Little Sodus Bay, Oswego, Sacketts Harbor, and Pultneyville, N. Y.; in charge of survey of shoal near Fort Niagara, and of examination for harbor of refuge in Mexico Bay, Lake Ontario; in charge of water-level observations on Lake Ontario; member of board of engineer officers to consider and report upon the subject of harbor lines at Oswego, N. Y.
William M. Black	Commanding Company C, Battalion of Engineers. Instructor in civil engineering at the U. S. Engineer School. Member of general courts-martial convened at Willets Point, N. Y., March 24 and September 21, 1892.
Walter L. Fisk.....	In charge of the improvement of the harbors of Duluth, Grand Marais, Agate Bay, Minn.; Superior Bay on Lake Superior, St. Louis Bay, and Ashland, Wis.; Ontonagon, Eagle Harbor, and Marquette, harbor of refuge at Grand Marais, Mich., and of Minnesota Point at Superior, Wis. In charge of examination of Allouez Bay and Nemadji River, at Superior, Wis. In charge of water-level observations on Lake Superior. To exercise supervision over construction of two bridges across the St Louis River between the States of Minnesota and Wisconsin. Commanding Company A, Battalion of Engineers. Instructor in submarine mining at the U. S. Engineer School.
Solomon W. Roessler...	In charge of the first district of the Mississippi River from Cairo to foot of Island No. 40, and of second district from foot of Island No. 40 to mouth of White River, for the purpose of improvement and the construction and repair of levees. In charge of examinations of harbor at Memphis, including removal of bar forming opposite the upper part of the city, and bank protection along the city front, and of Wolf River, Tenn. To exercise supervision over construction of bridge across the Mississippi River at Memphis, Tenn. Member of board of engineer officers on building and repair of levees on the Mississippi River.
George McC. Derby	Detached; on duty at the Military Academy as instructor in practical military engineering, and in command of Company E, Battalion of Engineers. In charge of the preservation and repairs of Fort Clinton and the batteries at the Military Academy; of water works and supply line; of post school for enlisted men; and the construction of a new gymnasium at West Point, N. Y. Acting signal officer. Detached; assistant to the Engineer Commissioner of the District of Columbia.
James L. Lusk.....	Detached; assistant to the Engineer Commissioner of the District of Columbia. Detached; on duty at the Military Academy as instructor in practical military engineering, and in command of Company E, Battalion of Engineers. In charge of the water supply, and of post school for enlisted men at West Point, N. Y. Acting signal officer. To supervise the construction of the new academic building and of the Battle Monument at West Point, N. Y.
Frederic V. Abbot.....	In charge of the defensive works at Forts Moultrie, Sumter, and Johnson, and Castle Pinckney, S. C. In charge of the improvement of the harbor at Charleston,

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued)	
Frederic V. Abbot.....	S. C. In charge of the improvement of Lumber River, and of Waccamaw River, N. C. and S. C.; of the Ashley, Edisto, Salkiehatchie, Little Pee Dee, Great Pee Dee, Santee, Wateree, Congaree, Clark, and Beaufort rivers, Mingo Creek, and Wappoo Cut, S. C. In charge of examination of Lynch River, S. C. In charge of removal of two wrecks in Quinby Creek, and one in Cooper River; and of wreck of schooner *Kate V. Aitkens* in Charleston Harbor, S. C. To supervise the construction of bridges across Lumber River, N. C.; across the cove at Sullivans Island; and across Santee River, S. C.
Thomas L. Casey.....	In charge of the improvement of Keyport Harbor, N. J., and harbor at Canarsie Bay, N. Y. In charge of the improvement of Arthur Kill between Staten Island and the New Jersey shore, N. Y. and N. J. In charge of the improvement of the rivers Shrewsbury, Rahway, Elizabeth, South, Raritan, and Passaic, mouth of Squan River, Shoal Harbor and Compton Creek, and Mattawan Creek, N. J.; Sheepshead Bay and Sumpawanus Inlet, N. Y., and channel between Staten Island and New Jersey. In charge of examinations of Whale Creek, N. J.; channel connecting Freeport with Great South Bay; and of Seaford Creek, Long Island, N. Y. To supervise the use of the United States dike on Newark Bay front; the construction of bridges across Newark Bay at Newark, across Shrewsbury River at Highland Beach, and across Hackensack River, N. J. Member of boards of engineer officers to consider and report upon the subject of the harbor lines in Stamford Harbor; at Norwalk, and at Bridgeport, Conn.
Theodore A. Bingham..	Detached; military attaché to the United States legation at Berlin. Detached; military attaché to the United States legation at Rome.
Curtis McD. Townsend.	In charge of third district of the Mississippi River, from mouth of White River to Warrenton, for the purpose of improvement and the construction and repair of levees, to include the improvement of the harbor at Vicksburg, Miss. Member of board of engineer officers on building and repair of levees on the Mississippi River.
Gustav J. Fiebeger.....	Detached; Assistant to the Engineer Commissioner of the District of Columbia. Executive Officer, Rock Ceeek Park Commission, by virtue of act of Congress approved Sept. 27, 1890.
Oberlin M. Carter	In charge of the defensive works at Forts Oglethorpe and Pulaski, Ga., and Clinch, Fla. In charge of the improvement of the harbors at Savannah, Brunswick, and Darien, Ga. In charge of the improvement of Cumberland Sound, Savannah, Altamaha, Ocmulgee, and Oconee rivers, and Jekyl Creek, Ga., and inside route between Savannah, Ga., and Fernandina, Fla. In charge of examination of Savannah River between Spirit Island and the point where the Charleston and Savannah Railway crosses the said river, Ga. In charge of removal of wreck of bark *Undine* in Savannah Harbor, Ga. To exercise supervision over the construction of bridges across the Oconee, Ocmulgee, Satilla, Altamaha, Ogeechee, and St. Marys rivers, Ga.
George W. Goethals	In charge of the improvement of Tennessee River from Chattanooga to the foot of Bee Tree Shoals.
John Millis.....	In charge of fourth district of the Mississippi River, from Warrenton to Head of the Passes, for the purpose of im-

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	
John Millis.....	provement and the construction and repair of levees, to include levees and special work on the river, the improvement of the harbor at New Orleans, the Mississippi River at Natchez and Vidalia, the mouth of Red River, and at the mouth of Bayou Plaquemine, and the rectification of the Red and Atchafalaya rivers at mouth of Red River. To supervise the construction of bridge across Mississippi River above New Orleans, La. Member of board of engineer officers on building and repair of levees on the Mississippi River.
John Biddle.....	On duty under the immediate orders of Lieut. Col. Robert. In charge of the improvement of the rivers Tennessee above Chattanooga, Tenn., and below Bee Tree Shoals, Cumberland above and below Nashville, Ky. and Tenn., Hiawassee, Caney Fork, French Broad, Little Pigeon, Clinch, and Obion, Tenn. To exercise supervision over the construction of bridges across the Tennessee River at or near Knoxville, and at Johnsonville, Tenn.
Harry F. Hodges.....	Detached; on duty at the Military Academy as Assistant Professor of Civil and Military Engineering. On duty under the immediate orders of Maj. Stickney. Member of boards of engineer officers to consider and report upon the subject of harbor lines at Pittsburg, Pa., and on the Ohio to Davis Island Dam; on both sides of the Ohio River from the upper end of Martins Ferry to the lower end of the city of Bellaire, Ohio; and at Cincinnati, including the Licking River between its mouth and the bridge of the Louisville and Nashville Railroad. In charge of the improvement of the Missouri River from the Great Falls, Mont., to Sioux City, Iowa, including removing snags and other like obstructions above Sioux City, and of the Yellowstone River, Mont. and N. Dak. In charge of survey of Missouri River between Sioux City, Iowa, and Fort Benton, Mont.; and of examination of Missouri River from Three Forks to Canyon Ferry, Mont.
FIRST LIEUTENANTS.	
James G. Warren.....	On duty under the immediate orders of Lieut. Col. Gillespie. Member of board of engineer officers to test the workings of the mechanism of a 12-inch gun-lift.
Edward Burr.....	In charge of the improvement of the harbor at Norfolk, and the approach to Norfolk Harbor and the United States Navy Yard, Va. In charge of the improvement of Appomattox, Chickahominy, and Nansemond rivers, including mouths of Bennett and Chuckatuck creeks, Va., North Landing River, and inland water route from Norfolk Harbor, Va., to Albemarle Sound, N. C. In charge of examination of harbor at Petersburg and Appomattox River, for diversion of waters of Old North Channel above city, Va. In charge of removal of wrecks of schooners *Lulu*, near Thimble Shoal Light, Chesapeake Bay; *Edith Berwind* and *Mary E. H. G. Dow* near Cape Charles, Va. Secretary of board of engineers to consider and report upon the obstructions in the Columbia River between Three Mile Rapids and Celilo Falls.
Lansing H. Beach	Detached; on duty at the Military Academy in Department of Civil and Military Engineering. To supervise the construction of the Battle Monument at West Point, N. Y. Member of general court-martial convened at West Point, N. Y., Feb. 7, 1893.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
FIRST LIEUTENANTS. (continued.)	
Graham D. Fitch	On duty under the immediate orders of Capt Symons.
George A. Zinn	On duty under the immediate orders of Maj. Davis.
William C. Langfitt	On duty under the immediate orders of Maj. Allen. In charge, temporarily, of the improvement of the entrance to Galveston Harbor and of the harbor at Brazos Santiago; of the ship-channel in Galveston Bay, the channel in West Galveston Bay, Buffalo Bayou, Trinity River, and Cedar Bayou; of examination of Brazos River, from its mouth to Richmond, and the supervision over the construction of bridges across West Bay, from Galveston Island to Virginia Point; across Chocolate and Bastrop; Dickinson and White Oak bayous, Tex. On duty under the immediate orders of Maj. Miller.
Henry E. Waterman	On duty under the immediate orders of Maj. Gregory. On duty under the immediate orders of Maj. Lockwood. Member of boards of engineer officers to consider and report upon the subject of the harbor lines at Pittsburg, Pa., and on the Ohio to Davis Island Dam; on both sides of the Ohio River from the upper end of Martins Ferry to the lower end of the city of Bellaire, Ohio; and at Cincinnati, including the Licking River between its mouth and the bridge of the Louisville and Nashville Railroad.
James C. Sanford	Secretary and Disbursing Officer of the Missouri River Commission created by act of Congress approved July 5, 1884.
Hiram M. Chittenden	On duty under the immediate orders of Maj. Jones. On duty under the immediate orders of Lieut. Col. Lydecker.
Cassius E. Gillette	Detached; engineer officer Department of the Missouri.
David DuB. Gaillard	Detached; member of International Boundary Commission for the location and marking of the boundary between the United States and Mexico, under the direction of the Secretary of State.
Harry Taylor	On duty under the immediate orders of Maj. Handbury,
William L. Sibert	On duty under the immediate orders of Maj. Lockwood. On duty under the immediate orders of Col. Poe.
Joseph E. Kuhn	Detached; on duty at the Military Academy in Department of Civil and Military Engineering. To supervise the erection of a new academic building at West Point, N. Y.
William E. Craighill	On duty under the immediate orders of Capt. Price.
Henry C. Newcomer	On duty under the immediate orders of Col. Mendell. Detached; on duty at the Military Academy in Department of Civil and Military Engineering. Member of general court-martial convened at West Point, N. Y., Feb. 7, 1893.
Mason M. Patrick	Detached; on duty at the Military Academy as assistant instructor in practical military engineering, and with Company E, Battalion of Engineers. Recruiting officer for Company E, Battalion of Engineers. In charge of post school for soldiers' children at West Point, N. Y., temporarily in command of Company E, Battalion of Engineers; in charge of the preservation and repair of the batteries; of waterworks and supply line, and of post school for enlisted men at West Point, N. Y. Member of general courts-martial convened at West Point, N. Y., May 23 and Dec. 1, 1892.
Charles S. Riché	On duty under the immediate orders of Col. Poe. Member of board of engineer officers to consider and report upon the subject of harbor lines at Detroit, Mich.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
FIRST LIEUTENANTS. (continued.	
Thomas H. Rees	On duty under the immediate orders of Capt. Carter. On duty under the immediate orders of Col. Houston. In charge, temporarily, of the defensive works at Forts Griswold and Trumbull, Conn.; Columbus, Wood, Wadsworth, and Tompkins and its batteries, Castle Williams, South Battery, at Governors Island, of sea wall at same, and of sea wall at Davids Island, New York; of construction of gun batteries on Staten Island for defense of New York; of the improvement of the harbors of Clinton, New Haven, Bridgeport, Black Rock, Norwalk, Five Mile River, Wilsons Point, Stamford, Cos Cob and Miamus River, Connecticut, and Greenport, Port Chester, Glen Cove, Flushing Bay, Port Jefferson Inlet, Larchmont, and Huntington, N. Y.: of the harbor of refuge, Duck Island Harbor; and the construction of breakwaters at New Haven, Conn.; of the Housatonic River and for breakwater; Thames River, including Shaws Cove, New London Harbor; Mystic and Saugatuck Rivers, Connecticut, Connecticut River, Massachusetts and Connecticut, and East Chester Creek, Patchogue River, and Browns Creek, New York. On duty under the immediate orders of Lieut. Col. Robert.
Charles L. Potter	On duty under the immediate orders of Lieut. Col. Benyaurd.
Francis R. Shunk	On duty under the immediate orders of Captain Symons. In charge, temporarily, of the improvement of harbor at Yaquina Bay, entrance to harbor at Nehalem Bay, mouth of Siuslaw River, Umpqua and Coquille rivers, Tillamook Bay, entrance and harbor at Coos Bay, and Upper Coquille River between Coquille City and Myrtle Point, Oregon; the Upper Columbia and Snake rivers, Oregon and Washington; Upper Snake River between Huntington Bridge and Seven Devils mining district, Idaho; Olympia Harbor, Gray's Harbor, and Chehalis River; the Columbia River from the head of Rock Island Rapids to the foot of Priest Rapids; Puget Sound and its tributary waters; Swinomish Slough, Nasel River, and Willapa River and Harbor, Washington; and the supervision over the construction of bridges across Clearwater River above Lewiston, Idaho; across D'Wamish River near Seattle; across Snohomish River; across Chehalis River; across Swinomish Slough; across Skagit River at Mount Vernon; across Nooksack River at Ferndale and at Lyden; across South Bay, Elk River, between Bay City and Laidlaw; and across Columbia River between Douglas and Kittitas counties, Washington.
Eugene W. VanC. Lucas	On duty under the immediate orders of Maj. Stanton.
Henry Jervey	Quartermaster Battalion of Engineers. Acting assistant quartermaster and acting commissary of subsistence, Post of Willets Point; instructor in military photography at the U. S. Engineer School; inspector of small-arms practice, Battalion of Engineers; member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892. On duty under the immediate orders of Capt. Marshall.
James J. Meyler	On duty under the immediate orders of Lieut. Col. Benyaurd. On duty under the immediate orders of Maj. Lockwood.
Charles H. McKinstry	Detached; on duty at the Military Academy as assistant instructor in practical military engineering, and with Company E, Battalion of Engineers. Judge-advocate of general court-martial convened at West Point, N. Y.,

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
FIRST LIEUTENANTS. (continued.)	
Charles H. McKinstry..	Feb. 7, 1893. On duty under the immediate orders of Maj. Gregory.
William V. Judson	On duty under the immediate orders of Lieut. Col. Smith. On duty under the immediate orders of Maj. Mackenzie.
SECOND LIEUTENANTS.	
Eben E. Winslow	On duty under the immediate orders of Maj. Damrell.
Albert M. D'Armit.....	On duty under the immediate orders of Maj. Raymond. In charge, temporarily, of the defensive works at Fort Mifflin, Pa.; Fort Delaware, and fort opposite Fort Delaware, Del.; at Finns Point, and site for defenses at Red Bank, New Jersey; of the improvement of the harbors at Philadelphia, Pa. and N. J., and Delaware Breakwater, Delaware; ice-harbors at Marcus Hook, Pennsylvania, and the head of Delaware Bay, Delaware; of the Schuylkill River, Pennsylvania; Delaware River, from Trenton to its month, Rancocas and Salem rivers, and Alloway and Goshen creeks, New Jersey; and of removal of wrecks of steamer *Gaudaloup* and steam-tug *Starlight* in Barnegat Inlet, and of ship *Geestemunde* and steamer *Florida*, lying off Absecon Beach, New Jersey. In charge, temporarily, of the defensive works at Forts Marion and Taylor; of the improvement of the harbors at Key West, including entrance thereto, Tampa Bay, Cedar Keys, and St. Augustine; and of the St. Johns River, Volusia Bar, Caloosahatchee, Manatee, Withlacoochee, Suwanee, and Pease rivers, channel of Charlotte Harbor and Pease Creek, Ocklawaha River, Indian River between Goat Creek and Jupiter Inlet, and Sarasota Bay; and the supervision over the construction of bridge across St. Johns River at the Lake Monroe crossing, Florida.
Clement A. F. Flagler ..	On duty under the immediate orders of Col. Mendell. Member of general court-martial convened at Willets Point, N. Y., March 24, 1892.
Chester Harding	On duty under the immediate orders of Capt. Marshall.
William W. Harts.....	On duty under the immediate orders of Capt. Bixby. Member of general court-martial convened at Willets Point, N. Y., Mar. 24, 1892.
Robert McGregor.....	Adjutant and Treasurer of the Battalion of Engineers. Adjutant, Signal Officer, and Recruiting Officer, Post of Willets Point. Commanding Company D, Battalion of Engineers. Inspector of small-arms practice, Battalion of Engineers. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
Edgar Jadwin.....	On duty with Company B, Battalion of Engineers. Post Treasurer and Mess Officer, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Quartermaster Battalion of Engineers. Acting Assistant Quartermaster and Acting Commissary of Subsistence, Post of Willets Point. Instructor in Military Photography at the U. S. Engineer School. Member of the general court-martial convened at Willets Point, N. Y., March 24, 1892. Judge-advocate of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
Charles Keller.....	On duty with Company C, Battalion of Engineers. Acting Ordnance Officer, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
FIRST LIEUTENANTS. (continued.)	
Herbert Deakyne.....	On duty with Company A, Battalion of Engineers. Librarian of the Post and U. S. Engineer School libraries at Willets Point, N. Y., and in charge of the property pertaining thereto. Assistant to the Post Quartermaster at Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
Charles S. Bromwell....	On duty with Company A, Battalion of Engineers. Under instruction at the U. S. Engineer School. Detached; on duty with Company E, Battalion of Engineers, at the Military Academy.
ADDITIONAL SECOND LIEUTENANTS.	
Spencer Cosby	On duty with Company B, Battalion of Engineers. In charge of Post Exchange, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general courts-martial convened at Willets Point, N. Y., Mar. 24 and Sept. 21, 1892.
John S. Sewell	On duty with Company C, Battalion of Engineers. Officer in charge of Post Schools, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general courts-martial convened at Willets Point, N. Y., Mar. 24 and Sept. 21, 1892.
Charles P. Echols	On duty with Company A, Battalion of Engineers. Librarian of the Post and U. S. Engineer School libraries at Willets Point, N. Y., and in charge of the property pertaining thereto. Under instruction at the U. S. Engineer School. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
James F. McIndoe.....	On duty with Company B, Battalion of Engineers. Acting Ordnance Officer, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
Jay J. Morrow.....	On duty with Company A, Battalion of Engineers. On duty with Company C, Battalion of Engineers. Post Treasurer and Mess Officer, Post of Willets Point, N. Y. Under instruction at the U. S. Engineer School. Member of general court-martial convened at Willets Point, N. Y., Sept. 21, 1892.
James B. Cavanaugh...	On duty with Company B, Battalion of Engineers. Under instruction at the U. S. Engineer School.
James P. Jervey.....	On duty with Company C, Battalion of Engineers. Under instruction at the U. S. Engineer School.
George P. Howell	On graduating leave of absence.
Charles W. Kutz	On graduating leave of absence.
Meriwether L. Walker..	On graduating leave of absence.
Robert P. Johnston.....	On graduating leave of absence.
Robert R. Raymond....	On graduating leave of absence.
U. S. AGENT.	
William F. Smith, *Major of Engineers, U. S. A., retired.*	In charge of the improvement of the harbors at Wilmington, Del., Cambridge, Md., Onancock and Cape Charles City and Chenton Inlet, Va., and ice harbor at New Castle, Del. In charge of the improvement of the Broadkiln, Appoquinnimink, Smyrna, Murderkill, Mispillion, and Broad Creek rivers, Del.; Susquehanna River, Md. and Pa.; Choptank, Wicomico, Manokin, Chester, Latrappe, Warwick, Elk, and North East rivers, and of

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

NAME AND RANK.	DUTIES.
U. S. AGENT. (continued.)	
William F. Smith, *Major of Engineers, U. S. A., retired.*	Fairlee Creek or Inlet, Md., and inland waterway from Chincoteague Bay, Va., to Delaware Bay at or near Lewes, Del. In charge of survey to locate the canal between Rehoboth Bay and Delaware Bay—a part of the proposed waterway from Chincoteague Bay, Va., to Delaware Bay, and examinations of Nanticoke River, mouth of St. Jones River; for inland waterway connecting the Mispillion and Broadkiln rivers so as to reopen the navigation of Cedar, Slaughter, and Primehook creeks, Del.; Pocomoke River, with a view of uniting the waters of said river with the waters of Synepuxent Bay at a point above Snow Hill; and Black Walnut Harbor, at the mouth of Great Choptank River, Md. In charge of removal of wreck of steam-tug *Charles Lea* at junction of Mill Creek and Mispillion River. To supervise the construction of bridge across Christiana River in New Castle County, Del.
U. S. CIVIL ENGINEER.	
M. Meigs.....	On duty under thei mmediate orders of Maj. Mackenzie.

LAWS

AFFECTING

THE CORPS OF ENGINEERS,

UNITED STATES ARMY,

FIFTY-SECOND CONGRESS, SECOND SESSION.

1892-'93.

LAWS

AFFECTING

THE CORPS OF ENGINEERS, UNITED STATES ARMY.

FIFTY-SECOND CONGRESS, SECOND SESSION, 1892–'93.

PUBLIC ACTS.

CHAP. 16.—An act to authorize the Alabama Grand Trunk Railroad Company to bridge across the Talapoosa and Coosa Rivers. December 28, 1892. Vol. 27, p. 412.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Alabama Grand Trunk Railroad Company, organized under the laws of the State of Alabama, be, and is hereby, authorized to construct, maintain, and use a bridge, and approaches thereto, over the Talapoosa River, near Hatchett Ferry, and also a bridge, and approaches thereto, over the Coosa River, at some point between Cedar Bluff and Tripp Ferry, both of said proposed bridges being in the State of Alabama. Said bridges shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which either of said bridges may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers. Alabama Grand Trunk Railroad Company may bridge Talapoosa and Coosa rivers, Alabama. Railway, wagon, and foot bridges.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post route, and it shall enjoy the rights and privileges of other post roads in the United States; and, upon just compensation being paid to said company, equal privileges in the use of said bridge or bridges shall be granted to all telegraph and telephone companies; and the United States shall have the right of way, free of cost, over said bridge or bridges for postal telegraph purposes. Lawful structures and post-routes. Postal telegraph.

SEC. 3. That all railroad companies desiring the use of said bridge or bridges shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation to the said Alabama Grand Trunk Railroad Company, its successors and Use by other companies. Compensation.

assigns, for such use; and in case the owner or owners of said bridge or bridges, and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge or bridges, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Secretary of War to approve plans, etc.

SEC. 4. That the bridges authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of each of said bridges, when necessary to construct either of them, and a map of the location, giving for the space of one mile above and one mile below the proposed location the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the currents at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge or bridges is approved by the Secretary of War the bridge shall not be

Changes.

commenced or built; and should any change be made in the plan of either of said bridges during the progress of construction, such changes shall be subject to the approval of the Secretary of War; and the expense of such change, and of any other changes at any time required by the Secretary of War in either of said bridges, or the entire removal of either or both of said bridges after being completed, if the Secretary of War deems the same necessary, shall be paid by the persons or corporation owning or controlling said

Litigation.

bridge or bridges, and any action ensuing from the construction of said bridges, or either of them, shall be instituted and brought in the district court of the United States within whose jurisdiction any portion of said bridge or

Provisos.
Aids to navigation.

bridges may be located: *Provided*, That no bridge shall be built under the provisions of this act, except there also be built, at the time of the erection of the piers, such sheer booms, dikes, piers, or other suitable structures for the guiding of rafts, steamboats, and other water craft safely through the passageways as shall be required by the Secre-

Lights, etc.

tary of War: *And provided also*, That the said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridges as the Light-House Board shall prescribe.

Commencement and completion.

SEC. 5. That this act shall be null and void as to such bridge, herein provided for, on which actual construction is not commenced within one year and completed within three years from the date thereof; but shall remain in full force and effect as to such bridge, herein provided for, on which actual construction is commenced within one year and completed within three years from the date hereof.

SEC. 6. That Congress hereby expressly reserves the right to alter, amend, or repeal this act whenever the public interests so require. Amendment, etc.

Approved, December 28, 1892.

CHAP. 21.—An act authorizing the sale of land in the vicinity of Fort Mifflin on the river Delaware. January 6, 1893. Vol. 27, p. 414.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War and the Secretary of the Navy for the time being are authorized to sell, at such price as may be agreed upon by the Attorney-General and themselves, and convey to the International Navigation Company, a corporation created under the laws of the Commonwealth of Pennsylvania, subject to such conditions as they shall deem proper for the public interest, the right, title, and interest of the United States in and to so much of the land described in deed by John W. Ashmead and wife to the United States, dated the twenty-eighth day of March, eighteen hundred and fifty-one, being in the vicinity of Fort Mifflin on the river Delaware, lying outside the dike or river bank and eastward of the fort, as will, in the judgment of said Secretary of War, the Secretary of the Navy and the Attorney-General, not be prejudiced to the interests of the United States: *Provided*, That the right, title, and interest to so much of this land as may be needed as sites for dikes, shall be retained by the United States, together with the right to maintain and control said dikes. Fort Mifflin, Pa. Sale of land near, authorized. *Proviso.* Dikes, etc.

Approved, January 6, 1893.

CHAP. 24.—An act to amend an act approved April twenty-second, eighteen hundred and ninety, authorizing the Natchitoches Cane River Bridge Company to construct and maintain a bridge across Cane River, in Louisiana. January 9, 1893. Vol. 27, p. 415

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act approved April twenty-second, eighteen hundred and ninety, entitled "An act to authorize the Natchitoches Cane River Bridge Company to construct and maintain a bridge across Cane River, in Louisiana," be, and is hereby, amended so that the time within which the actual construction of said bridge may be commenced is hereby extended for the period of one year from the date of the approval of this act. Bridge across Cane River, La. Time for constructing extended. Vol. 26, p. 426.

Approved, January 9, 1893.

January 9, 1893. Vol. 27, p. 416.

CHAP. 25.—An act to amend an act approved March second, eighteen hundred and ninety-one, authorizing the construction of a bridge across the Red River, Louisiana, by the Rapides Bridge Company, limited.

Bridge across Red River, Alexandria, La.
Time for constructing extended.
Vol. 26, p. 826.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act approved March second, eighteen hundred and ninety-one, entitled "An act authorizing the Rapides Bridge Company, limited, to construct and maintain a bridge across the Red River at or near Alexandria, Louisiana," be, and is hereby, amended so that the time within which the actual construction of said bridge may be commenced is hereby extended for the period of one year from the date of the approval of this act.

Approved, January 9, 1893.

January 10, 1893. Vol. 27, p. 416.

CHAP. 28.—An act authorizing the construction of a bridge across the Columbia River, in the State of Washington.

Saint Paul, Minneapolis, and Manitoba Railway Company may bridge Columbia River, Wash.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Saint Paul, Minneapolis and Manitoba Railway Company, a corporation existing under the laws of the State of Minnesota, but empowered by the laws of the State of Washington to construct, maintain, and operate a railway within that State, and to its successors and assigns, to construct and maintain a bridge and approaches thereto across the Columbia River, in the State of Washington, at such point on said river between the counties of Douglas and Kittitas as may accommodate the line of railway which said corporation may build to said point. Said bridge shall be constructed to provide for the passage of railway trains, and at the option of the said corporation may be used for the passage of wagons and vehicles of all kinds, and for the transit of animals and for foot passengers for such reasonable rates of toll as may be fixed by the Secretary of War, and the Secretary of War shall have the right from time to time to revise such rates.

Railway, wagon, and foot bridge.

Tolls.

Unobstructed navigation.

SEC. 2. That the said bridge shall be so constructed that a free and unobstructed passage may be secured to all water craft, rafts, or logs navigating said river at the point aforesaid. The said bridge shall be located, built, and operated under and subject to such regulations for the securing of the navigation of said river and such requirements as to location and direction of piers and spans, clear heading in high water, and clear spans of low water, as the Secretary shall prescribe; and to secure that object the said company shall submit to the Secretary of War, for his examination and approval, drawings of said bridge and piers, and a map of the location, giving, for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the current at

Secretary of War to approve plans, etc.

ordinary high and low stages, and the soundings, accurately showing the bed and channel of the stream, and shall furnish such information as shall be required for a full and satisfactory understanding of the subject; and, until the said location and plan of the bridge hereby authorized to be constructed are approved by the Secretary of War, the said bridge shall not be commenced or built; and should any change be made in the plan of such bridge during the progress of construction or after completion thereof, such change shall be subject to the approval of the Secretary of War: *Provided*, That the persons or corporation owning said bridge shall maintain, at their own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Proviso. Lights, etc.

SEC. 3. The bridge authorized to be constructed under this act shall be a lawful structure and shall be recognized and known as a post route, upon which, also, no higher charge shall be made for the transmission over the same of the mails, troops, and munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile paid for their transmission over the railroads leading to said bridge; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes, and all telegraph or telephone companies shall have equal rights.

Lawful structure and post route.

Postal telegraph.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same and over the approaches thereto upon payment of a reasonable compensation for such use, and in case the owner or owners of said bridge, and the several railroad companies, or any one of them, desiring such use, fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties, and all telephone and telegraph companies shall have equal rights and privileges in constructing and operating their lines across said bridge.

Use by other companies.

Compensation

Telephone and telegraph lines.

SEC. 5. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Commencement and completion.

SEC. 6. That such alterations or changes as may be required by the Secretary of War or Congress in the bridge constructed under the provisions of this act shall be made by the said railroad company at its own expense, and at any time after the completion of the bridge; and the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require the entire removal of the bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it, is also expressly reserved.

Changes.

Amendment, etc.

Approved, January 10, 1893.

January 23, 1893. Vol. 27, p. 422.

CHAP. 44.—An act to amend "An act to promote the construction of a safe deep-water harbor on the coast of Texas," approved February ninth, eighteen hundred and ninety-one.

Padre Island harbor, Tex. Vol. 26, p. 741. Time extended for commencing.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section two of said act be so amended as to extend the time of commencing said work two years from the ninth day of February, eighteen hundred and ninety-three.

Approved, January 23, 1893.

January 26, 1893. Vol. 27, p. 422.

CHAP. 47.—An act to authorize the construction of bridges across the Hiwassee, the Tennessee, and the Clinch rivers, in the State of Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Fairmount Valley Railroad Company, a corporation existing under the laws of the States of Georgia and Tennessee, be, and is hereby, authorized to construct and maintain, to be used by it, its successors or assigns, for railway or other purposes, the following bridges over the rivers and at the localities named, that is to say:

Fairmount Valley Railroad Company may bridge Hiwassee, Tennessee, and Clinch rivers, Tenn.

Across the Hiwassee River at the most suitable and convenient point between the mouth of same and the town of Charleston, Tennessee.

Across the Tennessee River at the most suitable and convenient point within fifteen miles of its junction with the Clinch River.

Across the Clinch River at the most suitable and convenient point within fifteen miles of its junction with the Emory River.

Unobstructed navigation.

SEC. 2. That any bridge built under this act shall be constructed without material interference with the navigation of said rivers or either of them, beyond what is necessary to carry into effect the rights and privileges hereby granted, and the corporation, previous to commencing the construction of said bridges or either of them, shall submit to the Secretary of War a plan of the bridges or either of them, together with a detailed map of the river at the proposed site of each bridge and for a distance of a mile above and below its site, together with all information touching said bridges and rivers, either or all of them, as may be deemed requisite by the Secretary of War; that as nearly as practicable the said bridges shall be at right angles to and piers parallel with the current of said rivers; and, if it be found hereafter that said bridges or either of them materially interfere with the navigation of said rivers or either of them, it shall be the duty of the Secretary of War to require the necessary changes to be made therein at the expense of the owners; and said corporation may in its discretion construct and maintain ways for wagons, carriages, and for foot passengers over and upon said bridges or either of them, charging and receiving reasonable toll therefor, as may be approved from time to time by the Secretary of War: *Provided*, That as to any bridge built under

Plans to be submitted to Secretary of War.

Changes.

Ways for wagons, etc.

Toll.

Provisos.

this act none of the spans shall be less than one hundred feet in length: *And provided further;* That if without a draw there shall be at low water a clear width of water way between the piers of the channel span and at the highest water known a clear height between the lowest part of the superstructure and the water surface as follows: On the Hiwassee River and on the Clinch River above its junction with the Emory River, a width of one hundred and fifty feet and a height of thirty feet; on the Tennessee River a width of two hundred and fifty feet and a height of thirty-five feet; and on the Clinch below the Emory a width of one hundred and fifty feet and a height of thirty-five feet: *And provided also,* That if with a draw, then there shall be a clear height of at least five feet between the level of the highest water and the lowest part of the superstructure and a clear width of water way on each side of the pivot pier at low water of at least one hundred and fifty feet on the Tennessee River and one hundred and twenty feet on the Hiwassee and Clinch rivers: *Provided also,* That the widths stated in this section shall be measured at right angles to the direction of the channel: *Provided also,* That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said corporation shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Span.

High bridges.

Width and height of spans.

Drawbridges.

Opening draws.

Lights, etc.

SEC. 3. That the Secretary of War is hereby authorized and directed upon receiving such plans, map, and other information, and being satisfied that a bridge built on such plan and at such locality will conform to the conditions of this act, to notify the said corporation that he approves the same, and the said corporation may then, and not until then, proceed to the erection of said bridge or bridges, according to the approved plan and location; and should any change be made in the plan of said bridge or bridges during the progress of the work the same shall likewise be subject to the approval of the Secretary of War.

Secretary of War to approve plans, etc.

Changes.

SEC. 4. That any bridge and accessory works when built and constructed under this act shall be a lawful structure, and said bridge shall be known and recognized as a post route, upon which no higher charge shall be made for the transmission of mails, troops, and munitions of war of the United States than is charged over the railroad leading to said bridge; and said bridge shall enjoy the rights and privileges of other post routes in the United States, and the United States shall have a right of way for postal telegraph across said bridge.

Lawful structures and post routes.

Postal telegraph.

SEC. 5. That all railroad companies desiring the use of any bridge constructed under this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same and over the approaches thereto upon payment of reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid and upon rules and conditions to which

Use by other companies.

Compensation.

each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proof of the parties.

Commencement and completion.

SEC. 6. That this act shall be null and void if actual construction of the bridge or bridges herein authorized be not commenced within one year and completed within three years from the date of this act.

Amendment, etc.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, January 26, 1893.

January 26, 1893. Vol. 27, p. 424.

CHAP. 48.—An act to authorize the construction of a bridge across the Mississippi River above New Orleans.

Southern Bridge and Railway Company may bridge Mississippi River at New Orleans, La.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Southern Bridge and Railway Company, a corporation duly incorporated under the laws of the State of Louisiana, be, and the same is hereby, authorized and empowered to erect, construct, and maintain a bridge over the Mississippi River, the approach to which, on its left bank, shall be within the upper limits of the city of New Orleans, if practicable, or within five miles above said city limits, in the State of Louisiana, at such location as may be approved by the Secretary of War. Said bridge shall be constructed for the use and connections of the railroads on either side of the river, and for other purposes.

Lawful structure and post-route.

SEC. 2 That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops, and munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post roads in the United States.

Construction.

SEC. 3. That the said bridge shall be made with three unbroken and continuous spans between the river banks, as defined by a medium stage of water, and with

Main span.

but two piers in the river. The length of the main channel span shall be at least one thousand feet long, measured between the piers at the surface of the water at low water, and the height of the superstructure above high water shall be fixed and determined by the Secretary of War; and the bridge shall be at right angles to, and its piers parallel with, the current of the river: *Provided*, That the lower

Proviso. Minimum height.

chord of the bridge shall be horizontal and the lowest point of the superstructure shall not be less than eighty-five feet above extreme high water: *Provided, also*, That said Southern Bridge and Railway Company shall have posted in a conspicuous place, on or near the bridge, the clear headroom under the channel span on each day, the figures expressing this height to be not less than two feet high, and to be readily visible from any point in the channel of the

Notice of headroom.

river for a stretch of three thousand feet above and one thousand feet below the bridge. The bridge shall be located above the city of New Orleans. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the navigation of said river, and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States within whose jurisdiction any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same.

Unobstructed navigation.

Changes.

Litigation.

Existing legislation not affected.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies or any one of them desiring such use shall fail to agree upon the sum or sums to be paid and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon reasonable notice to the parties in interest, and upon consideration of such allegations and proofs as may be submitted to him. But the last foregoing provision shall not be held to exclude the ordinary jurisdiction of the courts of the United States in such cases.

Use by railroad companies.

Compensation.

Determination of disputes.

SEC. 5 That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge and a map of the location, giving, for the space of two miles above and two miles below the proposed location, the topography of the banks of the river, the shore lines at high and low water, and at least one medium stage, and the sounding, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built or commenced; and should any change be made in the plans of said bridge dur-

Secretary of War to approve plans, etc.

Changes.

ing the process of construction, such change shall be subject to approval of the Secretary of War, and shall not be made or commenced until the same is approved; and the said company or corporation shall cause to be displayed on said bridge from the hours of sunset to sunrise such lights or other signals as may be prescribed by the Light-House Board: *Provided*, That nothing in this section shall be construed as giving authority to the Secretary of War to diminish the height of bridge or the width of spans as specified in section three of this act.

Lights, etc.

Proviso.

Height and width.

Aids to navigation.

SEC. 6. That it shall be the duty of the Secretary of War, on satisfactory proof that a necessity exists therefor, to require the company or persons owning said bridge to cause such aids to the passage of said bridge to be constructed, placed, and maintained at their own cost and expense in the form of booms, dikes, piers, or other suitable and proper structures for the guiding of rafts, tows, steamboats, and other water craft safely through the passageway, as shall be specified in his order in their behalf, and on failure of the company or persons aforesaid to make and establish and maintain such additional structures within a reasonable time, the said Secretary may cause the said bridge to be removed at the expense of the owners thereof, or may proceed to cause the same to be built or made at the expense of the owners of said bridge, and in that case shall refer the matter without delay to the Attorney-General of the United States, whose duty it shall be to institute, in the name of the United States, proceedings in any circuit court of the United States within whose jurisdiction such bridge, or any part thereof, is located for the recovery of the amount so expended by the Government and all costs of such proceedings, and all moneys accruing from such proceedings shall be covered into the Treasury of the United States.

Removal of bridge on failure to provide.

Commencement and completion.

SEC. 7. That if the construction of the bridge hereby authorized shall not be commenced within two years from the time this act takes effect, and be completed within five years after the same date, then this act shall be void, and all rights hereby conferred shall cease and determine.

Amendment, etc.

SEC. 8. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal, at the expense of the owners, whenever the Secretary of War shall decide that the public interests require it, is also expressly reserved.

Approved, January 26, 1893.

January 28, 1893. Vol. 27, p. 426.

CHAP. 51.—An act relating to post tradership.

Post tradership.

Vacancies not to be filled.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That where a vacancy now exists or hereafter occurs in the position of post trader at any military post it shall not be filled, and the authority to make such appointment is hereby ter-

minated: *Provided*, That in the event of the death of a post trader his personal representative shall be allowed by the Secretary of War a reasonable time in which to close the business. *Proviso.* Closing business of deceased traders.

Approved, January 28, 1893.

CHAP. 53.—An act to amend "An act authorizing the construction of a railway, street railway, motor, wagon, and pedestrian bridge over the Missouri River, near Council Bluffs, Iowa, and Omaha, Nebraska, and to extend the time for the completion of the bridge therein provided for." January 28, 1893. Vol. 27, p. 427.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section eight of the act entitled "An act authorizing the construction of a railway, street railway, motor, wagon, and pedestrian bridge over the Missouri River, near Council Bluffs, Iowa, and Omaha, Nebraska," be amended to read as follows: Bridge over the Missouri River at Council Bluffs, Iowa, and Omaha, Nebr. Vol. 26, p. 762.

"SEC. 8. That this act shall be null and void if construction of said bridge shall not be commenced on or before the first day of January, eighteen hundred and ninety-two, and be completed on or before the first day of July, eighteen hundred and ninety-eight: *Provided*, That the navigation of the Missouri River shall not be obstructed by false works during the construction of the bridge." Time for construction extended. *Proviso.* Navigation not to be obstructed.

Approved, January 28, 1893.

CHAP. 57.—An act to authorize the construction of a bridge across the Osage River, between the mouths of Pomme de Terre River and Buffalo Creek, in Benton County, Missouri. February 3, 1893. Vol. 27, p. 428.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Springfield, Sedalia, Marshall and Northern Railroad Company, a corporation organized under the laws of the State of Missouri, or its successors or assigns, to construct a bridge across the Osage River at a point between the mouths of Pomme de Terre River and Buffalo Creek, in the county of Benton and State of Missouri; that said bridge may be constructed for railway, wagon, and postal service, with single or double track for railway traffic, and which shall be under the conditions and limitations hereinafter specified. Springfield, Sedalia, Marshall and Northern Railroad Company may bridge Osage River, Mo. Railway and wagon bridge.

SEC. 2. That said bridge shall not interfere with the free navigation of said river beyond what may be necessary to carry into effect the rights and privileges herein granted and in case of any litigation arising under the provisions, of this act such litigation may be tried and determined by the circuit court of the United States within whose jurisdiction said bridge is located. Unobstructed navigation. Litigation.

SEC. 3. That the bridge hereby authorized to be constructed shall be constructed as a drawbridge, having one draw span giving, when open, two clear waterways of not Draw.

less than eighty feet in width each at low water and two or more fixed spans not less than one hundred and twenty-five feet each, and all spans shall have a clear headroom of not less than ten feet above high-water mark: *Provided*, That the said draw shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over the draw; but in no case shall unnecessary delay occur in opening the said draw.

Proviso.

Opening draw.

Lawful structure and post route.

SEC. 4. That any bridge constructed under this act shall be a lawful structure and shall be known as a post-road, and the same is hereby declared to be a post-road, over which no higher charge shall be made for the transmission of mails, troops, and munitions of war of the Government of the United States, or for passengers or freight passing over the same, than the rate per mile charged for their transportation over the railroad or public highways leading to the said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies. The United States shall have also the right of way over said bridge for postal-telegraph purposes.

Postal telegraph.

Use by railway companies.

SEC. 5. That all railway companies desiring to use said bridge shall be entitled to equal rights and privileges in using the same, including the machinery and fixtures thereto belonging, and also the approaches thereto, upon such terms and conditions as shall be prescribed by the Secretary of War upon hearing the allegations and proofs of the parties in interest, in case the parties in interest shall not be able to agree upon such terms and conditions.

Terms.

Secretary of War to approve plans, etc.

SEC. 6. That the said railway company before entering upon the construction of said bridge shall submit to the Secretary of War plans and drawings of said structure, together with a map of the location thereof for one mile above and one mile below said location, giving the topography of the banks of the river, the shore line at high and low water, the direction and strength of the current of said river at all stages of the water, showing also the bed of the river and the channel, with such other and further information as the Secretary of War may require; which said drawings and other information aforesaid shall be examined by him, and if he shall approve the same he shall so notify the said railway company of such approval; and thereupon said company may proceed to the erection of said bridge.

Changes.

The Secretary of War may make such alteration in such plans as he may deem necessary to the better protection of navigation, and such alterations shall be adopted by said railway company. The said railway company may at any time make any alterations deemed advisable to be made in said bridge, but must first submit such proposed alterations to the Secretary of War, and his approval shall be first had before they shall be authorized or made.

Aids to navigation.

SEC. 7. That the said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts through it both by day and night. There shall be displayed on said bridge, from sunset to sunrise,

Lights, etc.

such lights and signals as may be prescribed by the Light-

House Board, and such changes may be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of said railway, in order the more effectually to preserve the free navigation of said river, or the said structure shall be altogether removed if, in the judgment of the Secretary of War, the public good may require such removal, and without expense or charge to the United States.

Commencement and completion.

SEC. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Amendment, etc.

SEC. 9. That the right to alter, amend, or repeal this act is hereby especially reserved.

Approved, February 3, 1893.

CHAP. 61.—An act to provide for lowering the height of a bridge proposed to be constructed across the Ohio River between Cincinnati, Ohio, and Covington, Kentucky, by the Cincinnati and Covington Rapid Transit Bridge Company.

February 4, 1893. Vol. 27, p. 430.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Cincinnati and Covington Rapid Transit Bridge Company be, and is hereby, authorized and permitted to construct a general traffic highway bridge agross the Ohio River between the cities of Covington, Kentucky, and Cincinnati, Ohio, at the place and according to the plans of said bridge approved by the Secretary of War, except that the height of said bridge above low water shall be one hundred and five feet and four inches instead of one hundred and fifteen feet as now required by law and as shown by the plans approved by said Secretary of War: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of the law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same: *And provided further*, That the rights and privileges herein granted shall be null and void if actual construction of this bridge be not begun within one year and completed within three years from the date of the approval of this act.

Ohio River.

Height of bridge to be built by Cincinnati and Covington Rapid Transit Bridge Company.

Vol. 22, p. 415.

Provisos.
Existing laws not affected.

Commencement and completion.

Amendment, etc.

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

SEC. 3. That this act shall take effect from and after its passage.

Approved, February 4, 1893.

CHAP. 64.—An act relating to the anchorage and movement of vessels in the port of Chicago.

February 6, 1893. Vol. 27, p. 431.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury be authorized and directed

Chicago, Ill.

Anchorage grounds, etc., to be established by Secretary of War.

to define and establish anchorage grounds for vessels in the harbors of Chicago, and waters of Lake Michigan adjacent thereto, to adopt suitable rules and regulations in relation to the same, and also to adopt suitable rules and regulations governing the use of marked inshore channels in Lake Michigan in front of the city of Chicago, and to take all necessary measures for the proper enforcement of such rules and regulations.

Penalty for violation of rules.

SEC. 2. That in the event of the violation of any such rules or regulations by the owner, master, or person in charge of any vessel, such owner, master, or person in charge of such vessel shall be liable to a penalty of one hundred dollars, and the said vessel may be holden for the payment of such penalty, and may be seized and proceeded against snmmarily by libel for the recovery of the same in any United States district court for the district within which such vessel may be, and in the name of the officer designated by the Secretary of the Treasury.

Approved, February 6, 1893.

February 7, 1893. Vol. 27, p. 431.

CHAP. 65.—An act to amend an act approved August sixth, eighteen hundred and eighty-eight, entitled, "An act to authorize the construction of a bridge across the Alabama River."

Rights of Alabama Great Northwestern Railway Company to bridge Alabama River extended to Montgomery, Tuscaloosa and Memphis Railway Company. Vol. 25, p. 378.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the rights, powers, and privileges granted to the Alabama Great Northwestern Railway Company by the act of Congress entitled "An act to authorize the construction of a bridge across the Alabama River," and approved August sixth, eighteen hundred and eighty-eight, be, and the same are hereby, in all respects confirmed and extended to the Montgomery, Tuscalsosa and Memphis Railway Company, the successor of the said Alabama Great Northwestern Railway Company.

Time for construction extended.

SEC. 2. That the time within which said railway company was authorized to complete the construction of said bridge, which construction has already been begun in accordance with the provisions of said act, be, and the same is hereby, extended for three years from the date of the passage of this act.

Approved February 7, 1893.

February 7, 1893. Vol. 27, p. 431.

CHAP. 66.—An act to authorize the construction of a bridge across the Mobile River by the Chicago, Mobile and Gulf Ports Railroad Company.

Chicago, Mobile and Gulf Ports Railroad Company may bridge Mobile River at Mount Vernon Landing, Ala.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Chicago, Mobile and Gulf Ports Railroad Company, a corporation existing under the laws of Alabama, its successors and assigns, be, and is hereby, authorized to construct and maintain a bridge across the Mobile River at a place suitable to commerce and not interfering with navi-

gation, at a point near Mount Vernon Landing, in the State of Alabama, and to lay on or over said bridge a track or tracks for the more perfect connection of any railroad or railroads that are or shall be constructed to said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided. That said bridge shall not interfere with the free navigation of said river, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river by reason of the construction of said bridge, the cause may be tried before the circuit court of the United States in and for any district in whose jurisdiction any portion of said obstruction or bridge may be. Said bridge shall be constructed to provide for the passage of railroad trains.

Unobstructed navigation.

Railroad bridge.

SEC. 2. That said bridge shall be provided with one or more draw openings, each having not less than one hundred feet clear channel way at low water, and in addition to said draw openings one or more fixed channel spans, each having not less than one hundred feet clear channel way, and every part of the superstructure of said bridge shall give a clear headroom of not less than ten feet above extreme known high-water mark: *Provided*, That all spans shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw opening shall, if practicable, be located next or near shore: *Provided also*, That if the physical characteristics of the locality so require, and the interest of navigation be not injured thereby, the lengths of the fixed spans or the number of draw openings may be reduced: *Provided also*, That for any two adjacent draw openings of one hundred feet each, one draw opening of two hundred feet or more may be substituted if in the opinion of the Secretary of War the interest of navigation be not injured thereby.

Draw openings.

Provisos.

Spans.

Fixed spans.

Draw spans.

SEC. 3. That all draw spans authorized by this act shall be operated by steam or other reliable power, and shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over said span or spans; but in no case shall unnecessary delay occur in opening said draw after the passage of trains; and also that in case the opening of a draw is delayed by reason of the passing of a train after the signal has been given from a boat ready to pass through, the draw shall be opened for the passage of such boat before another train is allowed to pass over the said span or spans; nor shall there be any unnecessary delay in the passage of trains over the bridge.

Operating draw.

SEC. 4. That all piers shall be built as near as may be parallel with the current of the river at that stage of water which is most important for navigation, and the bridge itself shall be built as nearly as may be at right angles thereto; and that riprapping or other protection for imperfect foundations which will lessen the required water way shall not be permitted; and also that piers which will produce cross currents or bars dangerous to navigation shall not be constructed; and if after construction any piers or accessory works are found to produce the above-mentioned effects, or

Piers.

if any riprapping or other protection prohibited by this section is found to exist, the nuisance shall be abated or corrected under the direction of the Secretary of War, at the expense of the company or persons owning, controlling, or operating said bridge.

Approaches.

SEC. 5. That the approaches to said bridge shall be so designed and constructed as not to interfere with the free discharge of said river in seasons of flood; and any encroachment on the high-water cross section by piers, solid embankments, or otherwise, which will result in unduly accelerating the high-water current at the site of the bridge shall not be allowed.

Aids to navigation.

SEC. 6. That any corporation, company, or persons, owning, controlling, or operating the bridge built under the authority of this act, shall build and maintain at all times as accessory works to such bridge, such booms, piers, dikes, guard fences, and similar devices as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site, and for the guiding of rafts, steamboats, and other water craft safely under or through said bridge; and if at any time after the construction of the bridge and its accessory works, the approaches to draw openings, channel spans, or raft passages in said bridge are found to be dangerous or difficult of access by river traffic, the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the corporation, company, or persons owning, controlling, or operating said bridge to construct under his direction, and to maintain such additional sheer booms, dikes, and other devices as will obviate the difficulty mentioned, which additional sheer booms, dikes, and other devices shall be built and maintained at their own expense by said company or persons; and that said company or persons shall maintain, at their own expense, from sunset to sunrise, throughout the season of navigation, such lights and other signals on said bridge as may be required by the Light-House Board for the security of navigation.

Lights, etc.

Secretary of War to approve plans, etc.

SEC. 7. That the bridge authorized to be constructed by this act shall be located and built under and subject to such regulations for the security of navigation on said river as the Secretary of War shall prescribe; and to secure that object said corporation shall submit for his examination a design and drawings of the bridge, piers, approaches and accessory works, and a map of the location, giving, for a space of at least three miles above and one mile below the proposed location, the topography of the banks of and the shore lines at high and low water. This map shall be accompanied by others drawn on the scale of one inch to two hundred feet, giving, for a space of one-half of a mile above the line of the proposed bridge and one-quarter of a mile below, an accurate representation of the bottom of the river, by contour lines five feet apart determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage by triangulated observations on suitable floats. The

maps shall also show the location of other bridges in the vicinity, and shall give such information as the Secretary of War may require for a full and satisfactory understanding of the subject; and the construction of the proposed bridge shall not be commenced until the location and plans thereof are approved by the Secretary of War.

Changes, etc.

SEC. 8. That any bridge constructed under the authority of this act shall be built under the general supervision of the Secretary of War, and no changes or alterations in plans shall be made during the construction of said bridge or after its completion, unless such changes or alterations conform to the provisions of this act and are authorized by the Secretary of War; that such alterations and changes as may be required by the Secretary of War in said bridge so as to preserve free and convenient navigation shall be made under the direction of the Secretary of War at the expense of the company or persons owning, controlling, or operating said bridge. That during original construction or in carrying out any authorized changes or repairs of said bridge a navigable channel shall be preserved at the site of the bridge at all times, and the water way of the river shall not be obstructed to a greater extent than is absolutely necessary; and such lights and buoys shall be kept on all coffer dams, piles, and so forth, as may be necessary for the security of navigation.

Use by railroad companies.

Compensation.

SEC. 9. That all railroad companies desiring the use of the bridge authorized by this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of such bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties; and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies.

Lawful structure and post route.

SEC. 10. That the bridge constructed, maintained and operated under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation of said mails, troops, and munitions over the railroads and public highways leading to said bridge; and the United States shall have the right of way for postal telegraph and telephone purposes over said bridge.

Postal telegraph, etc.

Commencement and completion.

SEC. 11. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date of approval thereof.

Amendment, etc.

SEC. 12. That the right to alter, amend, or repeal this act is hereby expressly reserved ;and the right to require the entire removal of the bridge constructed under the provi-

sions of this act, at the expense of the owners thereof, whenever Congress or the Secretary of War shall decide that the public interests require it, it also expressly reserved.

Approved, February 7, 1893.

February 7, 1893. Vol. 27, p. 434.

CHAP. 67.—An act to amend "An act authorizing the construction of a high wagon bridge across the Missouri River at or near Sioux City, Iowa," and so forth.

Bridge across Missouri River at Sioux City, Iowa. Vol. 25, p. 850; Vol. 26, p. 79.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section seven of an act entitled "An act authorizing the construction of a high wagon bridge across the Missouri River at or near Sioux City, Iowa," approved March second, eighteen hundred and eighty-nine, as amended by an act entitled "An act to amend an act entitled 'An act authorizing the construction of a high wagon bridge across the Missouri River at or near Sioux City, Iowa,'" approved April thirtieth, eighteen hundred and ninety, be amended so that it shall read as follows:

Time for construction extended.

SEC. 7. That this act shall be null and void if the construction of said bridge shall not be commenced within two years and be finished on or before March second, eighteen hundred and ninety-four.

SEC. 2. That section one of said act of April thirtieth, eighteen hundred and ninety, be amended to read as follows:

Addition of "assigns." Vol. 26, p. 79.

"That it shall be lawful for the Pacific Short Line Bridge Company, or its assigns, to construct and maintain," and so forth.

And the addition of the words "and assigns" shall be made wherever in said section the words "the Pacific Short Line Bridge Company" appear: *Provided always*, That the franchises granted to said company by the aforesaid acts shall not be alienable until all judgments existing against said company at the time this act goes into effect have been paid and satisfied.

Proviso.

Alienation of franchise.

Approved, February 7, 1893.

February 9, 1893. Vol. 27, p. 437.

CHAP. 75.—An act to authorize the construction of a bridge across the Warrior River by the Montgomery, Tuscaloosa and Memphis Railway Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Montgomery, Tuscaloosa and Memphis Railway Company, a corporation created and existing under the laws of Alabama, its successors and assigns be, and is hereby, authorized to construct and maintain a bridge across the Warrior River at a place suitable to commence and not interfere with navigation, at a point in Tuscaloosa County, in the State of Alabama, and to lay on or over said bridge a track or tracks for the more perfect connection of any rail-

Montgomery, Tuscaloosa and Memphis Railway Company may bridge Warrior River, Ala.

road or railroads that are or shall be constructed to said river, on either or both sides thereof at or opposite said point, under the limitations and conditions hereinafter provided. That said bridge shall not interfere with the free navigation of said river, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, by reason of the construction of said bridge the cause may be tried before the circuit court of the United States in and for any district in whose jurisdiction any portion of said obstruction or bridge may be. Said bridge shall be constructed to provide for the passage of railroad trains.

Litigation.

Railroad bridge.

SEC. 2. That said bridge shall be provided with one or more draw openings, each having not less than one hundred feet clear channel way at low water, and in addition to said draw openings one or more fixed channel spans, each having not less than one hundred feet clear channel way; and every part of the superstructure of said bridge shall give a clear headroom of not less than ten feet above extreme known high-water mark: *Provided*, That all spans shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw opening shall, if practicable, be located next or near shore: *Provided also*, That if the physical characteristics of the locality so require, and the interest of navigation be not injured thereby, the lengths of the fixed spans or the number of draw openings may be reduced: *Provided also*, That for any two adjacent draw openings of one hundred feet each one draw opening of two hundred feet or more may be substituted if in the opinion of the Secretary of War the interest of navigation be not injured thereby.

Draws.

Provisions. Spans.

Length of spans.

Draw openings.

SEC. 3. That all draw spans authorized by this act shall be operated by steam or other reliable power, and shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over said span or spans; but in no case shall unnecessary delay occur in opening said draw after the passage of trains; and also that in case the opening of a draw is delayed by reason of the passing of a train after the signal has been given from a boat ready to pass through, the draw shall be opened for the passage of such boat before another train is allowed to pass over the said span or spans; nor shall there be any unnecessary delay in the passage of trains over the bridge.

Opening draw.

SEC. 4. That all piers shall be built as near as may be parallel with the current of the river at that stage of water which is most important for navigation, and the bridge itself shall be built as nearly as may be at right angles thereto; and that riprapping or other protection for imperfect foundations which will lessen the required water way shall not be permitted; and also that piers which will produce cross currents or bars dangerous to navigation shall not be constructed; and if after construction any piers or accessory works are found to produce the above mentioned effects, or if any riprapping or other protection prohibited by this section be found to exist, the nuisance shall be abated or corrected under the direction of the Secretary

Piers.

of War, at the expense of the company or persons owning, controlling, or operating said bridge.

Approaches.

SEC. 5. That the approaches to said bridge shall be so designed and constructed as not to interfere with the free discharge of said river in seasons of flood; and any encroachment on the high-water cross section by piers, solid embankments, or otherwise which will result in unduly accelerating the highwater current at the site of the bridge shall not be allowed.

Aids to navigation.

SEC. 6. That any corporation, company, or persons owning, controlling, or operating the bridge built under the authority of this act shall build and maintain at all times, as accessory works to such bridge, such booms, piers, dikes, guard fences, and similar devices as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site, and for the guiding of rafts, steamboats, and other water craft safely under or through said bridge; and if at any time after the construction of the bridge and its accessory works, the approaches to draw openings, channel spans, or raft passages in said bridge are found to be dangerous or difficult of access by river traffic, the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the corporation, company, or persons owning, controlling or operating said bridge to construct, under his direction, and to maintain such additional sheer booms, dikes, and other devices as will obviate the difficulty mentioned, which additional sheer booms, dikes, and other devices shall be built and maintained at their own expense by said company or persons; and that said company or persons shall maintain, at their own expense, from sunset to sunrise throughout the season of navigation, such lights and other signals on said bridge as may be required by the Light-House Board for the security of navigation.

Lights, etc.

Secretary of War to approve plans, etc.

SEC. 7. That the bridge authorized to be constructed by this act shall be located and built under and subject to such regulations for the security of navigation on said river as the Secretary of War shall prescribe; and to secure that object said corporation shall submit for his examination a design and drawings of the bridge, piers, approaches, and accessory works, and a map of the location, giving, for a space of at least three miles above and one mile below the proposed location, the topography of the banks of said river and the shore lines at high and low water. This map shall be accompanied by others drawn on the scale of one inch to two hundred feet, giving, for a space of one-half of a mile above the line of the proposed bridge and one-quarter of a mile below, an accurate representation of the bottom of the river, by contour lines five feet apart, determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage by triangulated observations on suitable floats. The maps shall also show the location of other bridges in the vicinity, and shall give such information as the Secretary of War may require for a full and satisfactory understanding of the subject; and the construction of the proposed

bridge shall not be commenced until the location and plans thereof are approved by the Secretary of War.

Changes, etc.

SEC. 8. That any bridge constructed under the authority of this act shall be built under the general supervision of the Secretary of War, and no changes or alternations in plans shall be made during the construction of said bridge or after its completion, unless said changes or alternations conform to the provisions of this act and are authorized by the Secretary of War; that such alternations and changes as may be required by the Secretary of War in said bridge so as to preserve free and convenient navigation shall be made under the direction of the Secretary of War at the expense of the company or persons owning, controlling, or operating said bridge. That during original construction or in carrying out any authorized change or repairs of said bridge a navigable channel shall be preserved at the site of the bridge at all times, and the water way of the river shall not be obstructed to a greater extent than is absolutely necessary, and such lights and buoys shall be kept on all coffer dams, piles, and so forth, as may be necessary for the security of navigation.

Use by railroad companies.

SEC. 9. That all railroad companies desiring the use of the bridge authorized by this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of such bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties; and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies.

Compensation.

Lawful structure and post route.

SEC. 10. That the bridge constructed, maintained, and operated under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation of said mails, troops, and munitions over the railroads and public higways leading to said bridge; and the United States shall have the right of way for postal telegraph and telephone purposes over said bridge.

Postal telegraph, etc.

Commencement and completion.

SEC. 11. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date of approval thereof.

Amendment, etc.

SEC. 12. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require the entire removal of the bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it, is also expressly reserved.

Approved, February 9, 1893.

February 9, 1893. Vol. 27, p. 439.

CHAP. 76.—An act for the construction and maintenace of a bridge across the Saint Lawrence River.

Saint Lawrence Railway Company may bridge Saint Lawrence River, N. Y. and Canada.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any bridge and its appurtenances which shall be constructed across the Saint Lawrence River from the American frontier, in Saint Lawrence County, in the State of New York, to Canada, by the Saint Lawrence Railway Company, a corporation incorporated under and pursuant to the provisions of an act of the legislature of the State of New York, known as chapter five hundred and thirty-five of the laws of eighteen hundred and ninety, and entitled "An act in relation to railroads, constituting chapter thirty-nine of the general laws," and approved by the governor June ninth, eighteen hundred and ninety, shall be lawful structures and shall be so held and taken, and are hereby authorized to be constructed and maintained as provided by the aforesaid act, anything in any law or laws of the United States to the contrary notwithstanding; and such bridge shall be, and is hereby, declared to be an established post road for the United States mails: but this act shall not be construed to authorize the construction of any bridge which shall not permit free navigation of said river to substantially the same extent as would be enjoyed under the provisions of the aforesaid act, heretofore enacted and now in force: *Provided, nevertheless*, That the location of any bridge, the construction of which is hereby authorized, shall be subject to the approval of the Secretary of War of the United States: *And provided further*, That the consent of the proper authorities of the Dominion of Canada shall have been obtained before any bridge hereby authorized shall be commenced or built.

Lawful structure and post route.

Free navigation.

Provisos.

Location.

Consent of Canada.

SEC. 2. That the bridge herein named shall be so built that the lowest part thereof at the spans hereinafter referred to shall not be less than one hundred and fifty feet above high water and located under and subject to such regulations for security of navigation as the Secretary of War of the United States shall prescribe; with a span over the Canadian channel of five hundred feet in length unless the natural channel will admit of a shorter one; but in no case shall abutments or piers be erected to interfere with the navigation of said channel, and a span over the channel on the American side of not less than five hundred feet: and to secure that object the said company or corporation shall submit to the Secretary of War of the United States, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the currents at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said

Spans.

Secretary of War to approve plans etc.

nd location of the bridge are approved by the Secre-
f War of the United States the bridge shall not be
nced or built; and should any change be made in
n of said bridge during the progress of construction
r completion such change shall be subject to the
al of the Secretary of War of the United States.
ll railroad companies desiring to use the said bridge
ave, and be entitled to, equal rights and privileges
passage of the same and in the use of the machinery
xtures thereof and all the approaches thereto under
on such terms as may be from time to time agreed
between said railway companies and the owners of
ridge; and in case they shall not agree upon the
then, and in that case, upon such terms and condi-
s shall be prescribed by the Secretary of War of the
l States upon hearing the allegations and proofs of
rties.

Use by railroad companies

Terms.

. 3. That the said Saint Lawrence Railway Company
naintain, at its own expense, such lights and other
s on said bridge as the United States Light-House
shall prescribe.

Lights, etc.

. 4. That this act shall be null and void if actual con-
on of the bridge herein authorized be not com-
d within one year and completed within three years
he date hereof.

Commencement and completion.

. 5. That the right to alter, amend, or repeal this act
o prevent or relieve all material obstructions to the
tion of said river, by the construction of said bridge,
by expressly reserved.
roved, February 9, 1893.

Amendment, etc.

P. 81.—An act to amend an act entitled "An act to authorize
ding of a railroad bridge at Little Rock, Arkansas."

February 11, 1893.
Vol. 27, p. 441.

t enacted by the Senate and House of Representatives of
ited States of America in Congress assembled, That
seven of an act entitled "An act to authorize the
g of a railroad bridge at Little Rock, Arkansas,"
ed March second, eighteen hundred and ninety-one,
nded so as to read as follows:

Bridge across Arkansas River at Little Rock, Ark.
Vol. 26, p. 797.

act shall be null and void, if construction on said
shall not be commenced on or before January first,
en hundred and ninety-four, and completed on or
January first, eighteen hundred and ninety-six; and
benefits of this act shall enure and belong to the
Rock Bridge and Terminal Railway Company, a cor-
on existing under the laws of Arkansas, its successors
gns: *Provided*, The navigation of the Arkansas River
ot be obstructed by false work during the construc-
said bridge.

Time for construction extended.

Proviso.
Unobstructed navigation.

roved, February 11, 1893.

[illegible]. CHAP. 82.—An act to authorize the construction of a bridge across the Cahaba River, in Bibb County, Alabama, by the Montgomery, Tuscaloosa and Memphis Railway.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Montgomery, Tuscaloosa and Memphis Railway Company, a corporation existing under the laws of Alabama, its successors and assigns be, and is hereby authorized to construct and maintain a bridge across the Cahaba River at a place suitable to commerce and not interfering with navigation, at a point in Bibb County, in the State of Alabama, and to lay on or over said bridge a track or tracks for the more perfect connection of any railroad or railroads that are or shall be constructed to said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided. That said bridge shall not interfere with the free navigation of said river, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, by reason of the construction of the said bridge, the cause may be tried before the circuit court of the United States in and for any district in whose jurisdiction any portion of said obstruction or bridge may be. Said bridge shall be constructed to provide for the passage of railroad trains.

Montgomery, Tuscaloosa and Memphis Railway Company may bridge Cahaba River, Ala.

Uninterrupted navigation.

Litigation.

Spans.

SEC. 2. That said bridge shall be provided with one or more openings, each having not less than one hundred feet clear channel way at low water, and in addition to said openings one or more fixed channel spans, if required by the Secretary of War, each having not less than fifty feet clear channel way; and every part of the superstructure of said bridge shall give a clear headroom of not less than six feet above extreme known high-water mark: *Provided*, That all spans shall be so located as to afford the greatest possible accommodation to the river traffic: *Provided also*, That if the physical characteristics of the locality so require, and the interest of navigation be not injured thereby, the lengths of the fixed spans or the number of openings may be reduced: *Provided also*, That for any two adjacent openings of one hundred feet each, one opening of two hundred feet or more may be substituted, if, in the opinion of the Secretary of War, the interests of navigation be not injured thereby.

Provisos.

Location of spans.

Length, etc.

Draw openings.

Operating draw.

SEC. 3. That all draw spans, if any are found necessary and are required by the Secretary of War, by this act shall be operated by steam or other reliable power, and shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over said span or spans; but in no case shall unnecessary delay occur in opening said draw after the passage of trains, and also that in case the opening of a draw is delayed by reason of the passing of a train after the signal has been given from a boat ready to pass through, the draw shall be opened for the passage of such boat before another train is allowed to pass over the said span or spans; nor shall there be any unnecessary delay in the passage of trains over the bridge.

Piers.

SEC. 4. That all piers shall be built as nearly as may be parallel with the current of the river at that stage of water which is most important for navigation, and the bridge itself shall be built as nearly as may be at right angles thereto; and that riprapping or other protection for imperfect foundations which will lessen the required water way shall not be permitted; and also that piers which will produce cross currents or bars dangerous to navigation shall not be constructed; and if after construction any piers or accessory works are found to produce the above-mentioned effects, or if any riprapping or other protection prohibited by this section, is found to exist, the nuisance shall be abated or corrected under the direction of the Secretary of War at the expense of the company or person owning, controlling, or operating said bridge.

Approaches.

SEC. 5. That the approaches to said bridge shall be so designed and constructed as not to interfere with the free discharge of said river in seasons of flood; and any encroachment on the high-water cross section by piers, solid embankments, or otherwise which will result in unduly accelerating the high-water current at the site of the bridge shall not be allowed.

Aids to navigation.

SEC. 6. That any corporation, company, or persons owning, controlling, or operating the bridge, built under the authority of this act, shall build and maintain at all times as accessory work to such bridge, such booms, piers, dikes, guard fences, and similar devices, as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site, and for the guiding of rafts, steamboats, and other water craft safely under or through said bridge; and if at any time after the construction of the bridge and its accessory works the approaches to draw openings, channel spans, or raft passages in said bridge are found to be dangerous or difficult of access by river traffic the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the corporation, company, or persons owning, controlling, or operating said bridge to construct, under his directions, and to maintain such additional sheer booms, dikes, and other devices as will obviate the difficulty mentioned, which additional sheer booms, dikes, and other devices shall be built and maintained at their own expense by said company or persons; and that said company or persons shall maintain, at their own expense, from sunset to sunrise such lights and other signals on said bridge as may be required by the Light-House Board for the security of navigation.

Lights, etc.

Secretary of War to approve plans, etc.

SEC. 7. That the bridge authorized to be constructed by this act shall be located and built under and subject to such regulations for the security of navigation on said river as the Secretary of War shall prescribe; and to secure that object said corporation shall submit for his examination a design and drawing of the bridge, piers, approaches, and accessory works, and a map of the location, giving for a space of one mile above and one mile below the proposed location the topography of the banks of the river and the

shore lines at high and low water. This map shall be accompanied by another, drawn on the scale of one inch to two hundred feet, giving for a space of one-half mile above the line of the proposed bridge and one-quarter mile below an accurate representation of the bottom of the river, by contour lines five feet apart, determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage by triangulated observations on suitable floats. The maps shall also show the location of other bridges in the vicinity, and shall give such information as the Secretary of War may require for a full and satisfactory understanding of the subject; and the construction of the proposed bridge shall not be commenced until the location and plans thereof are approved by the Secretary of War.

Changes, etc.

SEC. 8. That any bridge constructed under the authority of this act shall be built under the general supervision of the Secretary of War, and no changes or alterations in plans shall be made during the construction of said bridge or after its completion unless said changes or alterations conform to the provisions of this act and are authorized by the Secretary of War. That such alterations and changes as may be required by the Secretary of War in said bridge, so as to preserve free and convenient navigation, shall be made under the direction of the Secretary of War, at the expense of the company or persons owning, controlling, or operating said bridge. That during original construction, or in carrying out any authorized changes or repairs of said bridge, a navigable channel shall be preserved at the site of the bridge at all times, and the waterway of the river shall not be obstructed to a greater extent than is absolutely necessary, and such lights and buoys shall be kept on all cofferdams, piles, and so forth, as may be necessary for the security of navigation.

Use by railroad companies.

SEC. 9. That all railroad companies desiring the use of the bridge authorized by this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proof of the parties; and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies.

Compensation.

Lawful structure and post route.

SEC. 10. That the bridge constructed, maintained, and operated under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transportation over the same of the

mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation of said mails, troops, and munitions over the railroads and public highways leading to said bridge; and the United States shall have the right of way for postal, telegraph, and telephone purposes over said bridge.

Postal telegraph, etc.

SEC. 11. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date of approval thereof.

Commencement and completion.

SEC. 12. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require the entire removal of the bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it, is also expressly reserved.

Amendment, etc.

Approved, February 11, 1893.

CHAP. 106.—An act authorizing Velasco and Surfside Terminal Railway Company to construct a bridge across the Galveston and Brazos Canal.

February 14, 1893.
Vol. 27, p. 446.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Velasco and Surfside Railway Company, a corporation chartered under the laws of the State of Texas, is hereby authorized and empowered to erect, construct, maintain, and operate a bridge over and across the Galveston and Brazos Canal, in Brazoria County, Texas. Said bridge shall be constructed to provide for the passage of railway trains on and over a double or single track, as said Velasco and Surfside Railway Company may elect.

Velasco and Surfside Railway Company may bridge Galveston and Brazos Canal, Texas.

Railway bridge.

Draw.

SEC. 2. That said bridge shall be constructed with a draw or turn of sufficient capacity to afford free passage to such vessels and boats as navigate said channel: *Provided*, That said bridge shall be opened promptly upon reasonable signal for the passage of boats and other water craft, except when trains are passing over the draw or turn; but in no case shall unnecessary delay occur in opening the draw or turn after the passage of trains or at any other time; and the said Velasco and Surfside Railway Company shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the United States Light-House Board shall prescribe. And no bridge shall be erected and maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said canal; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of such bridge to be made as will effectually obviate such obstruction, and all such alteration shall be made and such obstructions be re-

Provisos.
Opening draw.

Lights, etc.

Free navigation.

moved at the expense of the owner of said bridge. And in case of any obstruction, or alleged obstruction, to the navigation of said canal caused, or alleged to be caused, by said bridge, the case may be brought in the circuit court of the United States in which any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of navigation of rivers, or to exempt this bridge from the operations of the same. That all railroad companies desiring the use of any bridge constructed under this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same and over the approches thereto upon payment of a resonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Litigation.

Existing laws not affected

Use by other companies.

Compensation.

Secretary of War to approve plans, etc.

SEC. 3. That any bridge authorized to be constructed under this act shall be located and built under and subject to such regulations for the security of said canal as the Secretary of War shall prescribe; and to secure that object the said corporation shall, at least two months previous to the commencement of the construction of said bridge, submit to the Secretary of War for his examination and approval a design and drawing of the bridge and a map of the location, giving such information as may be necessary to enable the Secretary of War to judge of the proper location of said bridge, and shall furnish such information as may be required for a full and satisfactory understanding of the subject; and until such plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

Changes.

Amendment, etc.

SEC. 4. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

Commencement and completion.

SEC. 5. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the passage of this act.

Approved, February 14, 1893.

CHAP. 107.—An act to authorize the construction of a bridge across the Saint Marys River, between the States of Florida and Georgia. February 14, 1893. Vol. 27, p. 447.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Florida Central and Peninsular Railroad Company, a corporation existing under the laws of the State of Florida, and the Florida Northern Railroad Company, of Georgia, a corporation existing under the laws of the State of Georgia, or their successors or assigns, be, and hereby are, authorized to construct and maintain a bridge for railroad and other purposes over and across the Saint Marys River, between the States of Georgia and Florida, on the line of their railroad, from Harts Road, in the State of Florida, to Savannah, in the State of Georgia, and at such precise point on said river as may be fixed or approved by the Secretary of War.

Florida Central and Peninsular Railroad Company and Florida Northern Railroad Company may bridge Saint Marys River, Georgia and Florida.

SEC. 2. That said bridge shall be constructed for the passage of railroad trains, and, at the option of the corporation by which it may be built, for the transit of foot passengers, animals, wagons, and vehicles of all kinds, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

Railway, wagon, and foot bridge.

Tolls.

SEC. 3. That said bridge, when built and constructed under this act, and according to the terms and limitations thereof, shall be a lawful structure, and shall be recognized and known as a post route, upon which no higher charge shall be made for the transmission of mails, troops, and munitions of war of the United States than the rate per mile paid over the railroad leading to said bridge; and said bridge shall enjoy the rights and privileges of other post routes of the United States, and the United States shall have a right of way for postal telegraph over and across said bridge.

Lawful structure and post route.

Postal telegraph.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon the payment of reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid as such compensation, or upon rules and conditions to which each shall conform in using said bridge, all matters so at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Use by railroad companies.

Compensation.

Secretary of War to approve plans, etc.

SEC. 5. That said bridge shall be constructed and built without interference with the security and convenience of the navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted; and, in order to secure that object, the said corporation shall, before commencing the construction of said bridge, submit to the Secretary of War a plan and drawings of the bridge, and a map of the river and shores for a distance of a mile above and a mile below the proposed location, together with all information touching said bridge, its

approaches, and the river which said officer may deem requisite; and it shall be the duty of the Secretary of War, upon being satisfied that a bridge upon such plan and locus will conform to the conditions of this act, to notify said corporations that he approves the same; whereupon, and not sooner, said corporations may proceed to the erection of said bridge, conforming strictly to the approved plan and location; and likewise any change in the plan of the bridge or accessory works during the progress of the work thereon shall be subject to the approval of the Secretary of War: *Provided*, That if said bridge shall be constructed as a drawbridge, the draw shall be opened promptly upon reasonable signal for the passage of boats, and said corporation shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Changes.

Proviso.

Opening draw.

Lights, etc.

Amendment, etc.

SEC. 6. That Congress shall have power at any time to alter, amend, or repeal this act: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same.

Proviso.

Existing laws not affected.

Commencement and completion.

SEC. 7. That this act shall be null and void if actual construction of said bridge be not commenced within one year and completed within three years from the date of this act.

Approved, February 14, 1893.

February 14, 1893. Vol. 27, p. 448.

CHAP. 108.—An act to authorize the Homestead and Pittsburg Bridge Company to construct a bridge over the Monongahela River from Pittsburg to Homestead.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Homestead and Pittsburg Bridge Company, a corporation organized under the laws of the Commonwealth of Pennsylvania, to construct and maintain a bridge, and approaches thereto, over the Monongahela River from a point in the city of Pittsburg to a point in the borough of Homestead, in the county of Allegheny.

Homestead and Pittsburg Bridge Company may bridge Monongahela River at Pittsburg, Pa.

Railway, wagon, etc., bridge.

SEC. 2. That said bridge may be constructed to provide for the passage of railway trains, street cars, wagon roads, and vehicles of all kinds, for the transit of animals, foot passengers, and all kinds of commerce, travel, or communication, and said corporation may charge and receive reasonable tolls therefor, subject to the approval of the Secretary of War.

Tolls.

Lawful structure and post route.

SEC. 3. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post route, and it shall enjoy the rights and privileges of other post roads in the United States: *Provided*, That the United States may construct a postal telegraph over said bridge without charge therefor.

Proviso.

Postal telegraph.

SEC. 4. That said bridge shall be built and located under

and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object, the said corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the said bridge and a map of the proposed location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river and the shore lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and until the plan and location of said bridge have been approved by the Secretary of War, the bridge shall not be commenced or built.

Secretary of War to approve plans, etc.

SEC. 5. That all railroad companies desiring the use of any bridge constructed under this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same and over the approaches thereto, upon payment of reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proof of the parties.

Use by railroad companies.

Compensation.

SEC. 6. That said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts, both by day and by night, and there shall be displayed on said bridge, by the owners thereof, from sunset to sunrise, such lights or other signals as the Light-House Board may prescribe; and such changes shall be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of said bridge company, in order the more effectually to preserve the free navigation of said river.

Aids to navigation.

Lights, etc.

Changes.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure or its entire removal at the expense of the owners thereof, or the corporation or persons controlling the same, whenever public interest requires it, is also reserved.

Amendment, etc.

SEC. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Commencement and completion.

Approved, February 14, 1893.

February 15, 1893. Vol. 27, p. 455.

CHAP. 116.—An act to amend an act entitled "An act for the construction of a railroad and wagon bridge across the Mississippi River at South Saint Paul, Minnesota," approved April twenty-sixth, eighteen hundred and ninety.

Bridge across Mississippi River at South St Paul, Minn. Vol. 26, pp. 69, 788. Vol. 27, p. 3.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act entitled "An act for the construction of a railroad and wagon bridge across the Mississippi River at South Saint Paul, Minnesota," approved April twenty-sixth, eighteen hundred and ninety, and amended by an act approved February twenty-fourth, eighteen hundred and ninety-one, and also by an act approved February fifteen, eighteen hundred and ninety-two, be, and the same is hereby, further amended by extending the time within which the construction of said bridge shall be commenced to one year from the date of the approval of this act, and by extending the time within which said bridge shall be completed to three years from the same date.

Time for constructing extended.

Approved, February 15, 1893.

February 15, 1893. Vol. 27, p. 456.

CHAP. 118.—An act to authorize the Chesapeake and Ohio Railway Company to renew its railroad bridge across the Big Sandy River, upon such plans and location as may be approved by the Secretary of War.

Chesapeake and Ohio Railway Company may renew bridge across Big Sandy River, W. Va.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Chesapeake and Ohio Railway Company, a corporation organized under the laws of the States of Virginia and West Virginia, and now existing therein, be, and it is hereby, authorized to renew and operate its railroad bridge across the Big Sandy River near the site of its present bridge, upon such location and plans as may be approved by the Secretary of War: *Provided, however*, That the said bridge shall be so constructed as to cause the least obstruction to the navigation of the said river, and upon plans to be approved by the Secretary of War.

Proviso.

Secretary of War to approve plans, etc.

Amendment, etc.

SEC. 2. That the right to alter or repeal this act is hereby expressly reserved.

Approved, February 15, 1893.

February 15, 1893. Vol. 27, p. 457.

CHAP. 121.—An act authorizing the construction of a bridge over the Monongahela River at West Elizabeth, in the State of Pennsylvania.

West Elizabeth Bridge Company may bridge Monongahela River, Pa.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the West Elizabeth Bridge Company, a corporation duly organized under the laws of the Commonwealth of Pennsylvania, its successors and assigns, be, and they are hereby, authorized and empowered to construct, maintain, and operate a bridge over the Monongahela River between a point at or near the foot of Plum street, in the borough of Elizabeth, to a point in the borough of West Elizabeth,

on the opposite side of the said Monongahela River, all within the county of Allegheny and State of Pennsylvania. That said West Elizabeth Bridge Company shall not commence the construction of its bridge, bridge piers, abutments, causeway, and other works over or in said Monongahela River until the location and plan of the same shall have been submitted to and approved by the Secretary of War.

Inconsistent laws repealed.

SEC. 2. That any act of Congress or part of an act inconsistent herewith, so far as it affects the same, is hereby repealed.

Secretary of War to approve plans, etc.

SEC. 3. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and a map of the location, giving, for the space of one-half mile above and one-half mile below the proposed location, the high and low water lines upon the banks of the river, the direction and strength of the currents at low and at high water, with the soundings, accurately showing the bed of the stream and the location of any other bridge or bridges, such map to be sufficiently in detail to enable the Secretary of War to judge of the proper location of said bridge, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be commenced or built; and should any change be made in the plans of said bridge during the progress of its construction such changes shall be subject to the approval of the Secretary of War.

Changes.

Aids to navigation.

SEC. 4. That said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts, both by day and by night, and there shall be displayed on said bridge by the owners thereof, from sunset to sunrise, such lights or other signals as the Light-House Board may prescribe; and such changes shall be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of said bridge company, in order the more effectually to preserve the free navigation of said river.

Lights, etc.

Commencement and completion.

SEC. 5. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Amendment, etc.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, February 15, 1893.

March 3, 1891. Vol. 26, p. 1026.

CHAP. 535.—An act making appropriations for fortifications and other works of defense, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes.

Fortifications appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the sums of money herein provided for be, and the same are hereby, appropriated, out of any moneys in the Treasury not otherwise appropriated, to be available until expended, namely:

Gun and mortar platforms.

GUN AND MORTAR BATTERIES: For construction of gun and mortar platforms, fifty thousand dollars.

Sites.

SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES: For the procurement of land, or right pertaining thereto, needed for the site, location, construction, or prosecution of work for fortifications and coast defenses, One hundred and seventy five thousand dollars, or so much thereof as may be necessary.

Preservation, etc.

PRESERVATION AND REPAIR OF FORTIFICATIONS: For the protection, preservation, and repair of fortifications for which there may be no special appropriation available, forty five thousand dollars.

Plans.

For preparation of plans for fortifications, five thousand dollars.

* * * * * * *

Board of Ordnance and Fortification. Vol. 25, p. 489.

For the following, to be expended under the direct supervision of the Board of Ordnance and Fortification, created by the fortifications appropriation act approved September twenty-second, eighteen hundred and eighty-eight, and in the manner prescribed by said act, namely:

Purchases, tests, etc.

BOARD OF ORDNANCE AND FORTIFICATION: To enable the Board to make all needful and proper purchases, experiments, and tests to ascertain, with a view to their utilization by the Government, the most effective guns, small arms, cartridges, projectiles, fuses, explosives, torpedoes, armor plates, and other implements, and engines of war, and to purchase or cause to be manufactured, under authority of the Secretary of War, such guns, carriages, Armor plates, and other war materials and articles as may, in the judgment of the Board, be necessary in the proper discharge of the duty devolved upon it by the act approved September twenty-second, eighteen hundred and eighty-eight; to pay the salaries of the civilian members of the Board of Ordnance and Fortification, and for the necessary traveling expenses of said members when traveling on duty; for payment of the necessary expenses of the Board, including a per diem allowance to each officer detailed to serve thereon, when employed on duty away from his permanent station, of two dollars and fifty cents a day; and for the test of experimental guns and carriages procured in accordance with the recommendations of the Board of Ordnance and Fortification, one hundred and twenty-five thousand dollars;

Vol. 25 p. 489.

Civilian members.

Expenses.

Proviso.
No member to be interested in device, etc., before Board.

Provided, That hereafter no person shall be a member of or serve on said Board who has been or is in any manner interested in any invention, device, or patent which, or any-

thing similar to which, has been considered or may be considered by or come before said Board for test or adoption; or who is connected with or in the employ of any manufacturer who has or shall have contracts with the United States for any ordnance materials.

That all material purchased under the foregoing provisions of this act shall be of American manufacture, except in cases when, in the judgment of the Secretary of War, it is to the manifest interest of the United States to make purchases in limited quantities abroad, which material shall be admitted free of duty.

Purchases to be of American manufacture. Exception.

Approved, February 18, 1893.

CHAP. 140.—An act to authorize the Union Railroad Company to construct and maintain a bridge across the Monongahela River.

February 18, 1893. Vol. 27, p. 462.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Union Railroad Company, a corporation existing under the laws of the State of Pennsylvania, is hereby authorized to construct, maintain, and operate a railroad bridge across the Monongahela River, between a point in Mifflin Township and a point opposite in Wilkins Township, in Allegheny County, State of Pennsylvania; and said bridge, when built in accordance with the requirements of this act, shall be a legal structure, and may be used for railroad and highway purposes.

Union Railroad Company may bridge Monongahela River, Pa.

Legal structure.

SEC. 2. That any bridge built under the provisions of this act shall not be in any case of less elevation than fifty-four feet from the level of the water at pool full in said river to the bottom chord of the bridge, nor shall the main span be of less than three hundred and fifty feet in length in the clear, and the piers of the bridge shall be parallel with the current of the river, and the main span shall be over the main channel of the river at ordinary water.

Height, etc.

SEC. 3. That to secure a compliance with the conditions of this act the company, previous to commencing the construction of the bridge, shall submit to the Secretary of War a plan of the bridge and the location of its piers, with a detailed map of the river at the proposed site of the bridge and for a distance of three-fourths of a mile above and below the site, exhibiting the depths and currents at all points of the same and the location of any other bridge or bridges, together with all other information touching said bridge and river as may be deemed requisite by the Secretary of War to determine whether the said bridge when built will conform to the provisions of this act and cause no serious obstruction to the navigation of the river or injuriously affect the flow of water.

Plans, etc., to be submitted to Secretary of War.

SEC. 4. That the Secretary of War is hereby authorized and directed, upon receiving said plan and map, and upon being satisfied that a bridge built on such plan and at said locality will conform to the provisions of this act and cause

Secretary of War to approve plans, etc.

no serious obstruction to the navigation of the river or injuriously affect the flow of water, to notify the said company that he approves the same, and upon receiving such notification the said company may proceed to the erection of said bridge, conforming strictly to the approved plan and location. But until the Secretary of War shall approve the plan and location of the said bridge, and notify the said company of the same in writing, the bridge shall not be built or commenced; and should any change be made in the plan of the bridge during the progress of the work thereon such change shall be subject likewise to the approval of the Secretary of War.

Changes.

Railroad, wagon, and foot bridge.

SEC. 5. That said bridge shall be constructed to provide for the passage of railroad trains, and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

Tolls.

Use by other companies.

SEC. 6. That all railroad companies desiring the use of any bridge constructed under this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon the rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proof of the parties.

Compensation.

Aids to navigation.

SEC. 7. That said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts, both by day and by night; and there shall be displayed on said bridge by the owners thereof, from sunset to sunrise, such lights or other signals as the Light-House Board may prescribe; and such changes shall be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of the said company, in order the more effectually to preserve the free navigation of said river.

Lights, etc.

Commencement and completion.

SEC. 8. That this act shall be null and void unless the construction of said bridge shall be commenced within one year and completed within three years from the passage of this act.

Amendment, etc.

SEC. 9. That Congress shall have power at any time to alter, amend, or repeal this act.

Approved, February 18, 1893.

CHAP. 153.—An act granting certain rights and privileges to the commissioners of waterworks in the city of Erie, Pennsylvania. February 23, 1893. Vol. 27, p. 472.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the commissioners of waterworks in the city of Erie, State of Pennsylvania, be, and they are hereby, granted the right to lay, extend, and maintain their intake pipe from their present pumping station at the foot of Chestnut street, at Erie, Pennsylvania, across the Bay of Presque Isle to the peninsula, thence across the land belonging to the United States on the peninsula to the shore of Lake Erie, thence into the lake as far as may be advisable to secure pure water, together with the use of such land on the peninsula as may be needed for the proper laying, protection, and maintaining the pipe and the erection of all buildings necessary for the construction, care, and supervision of the work, and for maintaining the same.

Erie, Pa.

May lay water pipes across Government land.

Lands.

Also the use of such land belonging to the United States as may be required for a road, or roads, to and from the main land to place of crossing; all according to such plans and specifications as may be approved by the Secretary of War, and such plans shall be executed under his direction and supervision.

Use for roads granted.

SEC. 2. The right to alter, amend or repeal this act is hereby reserved.

Amendment, etc.

Approved, February 23, 1893.

CHAP. 156.—An act to amend "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved July thirteenth, eighteen hundred and ninety-two. February 24, 1893. Vol. 27, p. 474.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved July thirteenth, eighteen hundred and ninety-two, be amended in so far as the same provides for the improvement of Conneaut Harbor, Ohio, by striking out "for relocation of channel and construction of new piers" (scheme B, Engineer's report), and inserting "to widen and deepen the existing old channel" (scheme A, Engineer's report).

Conneaut Harbor, Ohio.

Change in improvement. Vol. 27, p. 93.

Approved, February 24, 1893.

CHAP. 159.—An act authorizing the construction of a bridge over the Monongahela River at the foot of Main street, in the borough of Bellevernon, in the State of Pennsylvania. February 24, 1893. Vol. 27, p. 475.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Bellevernon Bridge Company, a corporation duly authorized under the laws of the Commonwealth of Pennsylvania,

Bellevernon Bridge Company may bridge Monongahela River, Pa.

its successors and assigns, be, and they hereby are, authorized and empowered to construct, maintain, and operate a bridge over the Monongahela River, between a point at or near the foot of Main street, in the borough of Bellevernon, Fayette County, to a point in Washington County on the opposite side of said river, all within the State of Pennsylvania.

Secretary of War to approve plans, etc.

SEC. 2. That the said Bellevernon Bridge Company, its successors and assigns, shall not begin the construction of its bridge, piers, abutments, causeways, and other works over, in, or on said river until the location and plan of the same shall have been submitted to and approved by the Secretary of War.

Repeal of inconsistent laws.

SEC. 3. That any act of Congress or part of an act inconsistent herewith, so far as it affects the same, is hereby repealed.

Map, etc., to be submitted to Secretary of War.

SEC. 4. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe, and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and a map of the location, giving, for the space of one-half mile above and one-half mile below the proposed location, the high and low water lines upon the banks of the river, the direction and strength of the currents at low and at high water, with the soundings accurately showing the bed of the stream, and the location of any other bridge or bridges, such map to be sufficiently in detail to enable the Secretary of War to judge of the proper location of said bridge, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be commenced or built; and should any change be made in the plans of said bridge during the progress of its construction, such changes shall be subject to the approval of the Secretary of War.

Approval.

Aids to navigation.

SEC. 5. That said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts, both by day and by night; and there shall be displayed on said bridge by the owners thereof, from sunset to sunrise, such lights or other signals as the Light-House Board may prescribe; and such changes shall be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of the said bridge company, in order the more effectually to preserve the free navigation of said river.

Lights, etc.

Commencement and completion.

SEC. 6. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Amendments, etc.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, February 24, 1893.

CHAP. 168.—An act making appropriations for the support of the Army for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, and for other purposes. February 27, 1893. Vol. 27, p. 478.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and they are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the support of the Army for the year ending June thirtieth, eighteen hundred and ninety-four: Army appropriations.

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MISCELLANEOUS.

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For additional pay to officer in charge of public buildings and grounds in Washington, District of Columbia, one thousand dollars. Public buildings, Washington, D. C.

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ENGINEER DEPARTMENT. Engineer Department.

Engineer depot at Willets Point, New York: Incidental expenses of the depot, including fuel, lights, chemicals, stationery, hardware; extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine-drivers, teamsters, wheelwrights, masons, machinists, painters, overseers, laborers; repairs of and for materials to repair public buildings, machinery, and unforeseen expenses, four thousand dollars. Incidental expenses.

For purchase of materials for the instruction of engineer troops at Willets Point in their special duty as sappers and miners, for land and submarine mines, and pontoneers, torpedo drill, and signaling, thirty-five hundred dollars. Material.

For purchase and repair of instruments to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers for use on public works and surveys, three thousand dollars. Instruments.

Library of the Engineer School of Application: Purchase and binding of professional works of recent date treating of military and civil engineering and kindred scientific subjects, five hundred dollars; Books.

In all, eleven thousand dollars.

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Approved, February 27, 1893.

CHAP. 174.—An act authorizing the construction of a free bridge across the Arkansas River, connecting Little Rock and Argenta. February 28, 1893. Vol. 27, p. 494.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the county of Pulaski, State of Arkansas, to build a free wagon, foot, and street-railway bridge Pulaski County may bridge Arkansas River at Little Rock, Ark.

across the Arkansas River at the city of Little Rock, in Arkansas; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river by reason of the construction of said bridge, the cause may be tried before the district court of the United States having jurisdiction over that portion of the State of Arkansas where said bridge shall be located.

Litigation.

Drawbridge.

SEC. 2. That if any bridge built under the provisions of this act shall be constructed as a drawbridge, the same shall be constructed as a pivot drawbridge, with a draw over the main channel of the river, at an accessible and navigable point, and with the spans of not less than one hundred and sixty feet in length in the clear on each side of the pivot or central pier of the draw; and the next adjoining spans to the draw shall not be less than two hundred and fifty feet, and said span shall not be less than twenty feet above high-water mark, measuring to the bottom chord of the bridge: *And provided also*, That said draw shall be opened promptly upon reasonable signal for the passage of boats whose construction shall not be such as to admit of their passage under said bridge; and whatever kind of bridge be constructed the bridge piers shall be parallel with the current of the river. If said bridge shall have no draw, the span over the navigable channel shall be of such height above high water and such length between the piers as shall have been approved by the Secretary of War before construction of the same is commenced.

Spans, etc.

Proviso.
Opening of draw.

Piers.

Span over navigable channel.

Lawful structure and post route.

SEC. 3. That any bridge constructed under this act and according to its limitations shall be a lawful structure and shall be recognized as a post route, upon which no charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States.

Postal telegraph.

SEC. 4. That the United States shall have the right of way for telegraph purposes on said bridge; and all telegraph and telephone companies shall have equal rights and privileges as to constructing their lines over said bridge.

Use by telegraph, etc., companies.

Secretary of War to approve plans, etc.

SEC. 5. That the said county of Pulaski shall submit to the Secretary of War, for his approval, a plan, with the necessary drawings of said bridge, conforming to the above requirements; and until the Secretary of War approve the plan and location of said bridge, and notify the county court of the said county in writing, the bridge shall not be built or commenced; and should any change be made in the plan of said bridge during the progress of the work thereon, such change shall be likewise subject to the approval of the Secretary of War.

Lights, etc.

SEC. 6. That such lights or other signals as the Light-House Board may prescribe shall be maintained upon said bridge between sunset and sunrise, by and at the expense of the owner or owners thereof.

Commencement and completion.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the approval of this act.

SEC. 8. That Congress shall have power at any time to alter, amend, or repeal this act, or any part thereof, if, in its judgment, the public interests so require, and any change in the construction of such bridge hereby authorized, made necessary by the action of Congress, or the entire removal of the bridge, if required, shall be at the expense of the owners of said bridge or of the parties controlling or using the same. Amendment, etc. Changes.

Approved, February 28, 1893.

CHAP. 176.—An act to amend an act entitled "An act to grant to the Mobile and Dauphin Island Railroad and Harbor Company the right to trestle across the shoal water between Cedar Point and Dauphin Island," approved September twenty-sixth, eighteen hundred and ninety. February 28, 1893. Vol. 27, p. 496.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section four of the act entitled "An act to grant to the Mobile and Dauphin Island Railroad and Harbor Company the right to trestle across the shoal water between Cedar Point and Dauphin Island," approved September twenty-sixth, eighteen hundred and ninety, be, and the same is hereby, amended so as to read as follows: Mobile and Dauphin Island Railroad and Harbor Company's trestle between Cedar Point and Dauphin Island. Vol. 26, p. 480, amended.

"SEC. 4. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within three years and completed within five years from the date of the approval of this act." Construction and completion extended.

Approved, February 28, 1893.

CHAP. 183.—An act to create the California Debris Commission and regulate hydraulic mining in the State of California. March 1, 1893. Vol. 27, p. 507.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a commission is hereby created, to be known as the California Debris Commission, consisting of three members. The President of the United States shall, by and with the advice and consent of the Senate, appoint the commission from officers of the Corps of Engineers, United States Army. Vacancies occurring therein shall be filled in like manner. It shall have the authority, and exercise the powers hereinafter set forth, under the supervision of the Chief of Engineers and direction of the Secretary of War. California Debris Commission, created. Appointment. Authority and power.

SEC. 2. That said commission shall organize within thirty days after its appointment by the selection of such officers as may be required in the performance of its duties, the same to be selected from the members thereof. The members of said commission shall receive no greater compensation than is now allowed by law to each, respectively, as an officer of said Corps of Engineers. It shall also adopt rules and regulations, not inconsistant with law, to govern its deliberations and prescribe the method of procedure under the provisions of this act. Organization. Compensation. Rules, etc., of procedure.

Jurisdiction.

SEC. 3. That the jurisdiction of said commission, in so far as the same affects mining carried on by the hydraulic process, shall extend to all such mining in the territory drained by the Sacramento and San Joaquin river systems in the State of California. Hydraulic mining, as defined in section eight hereof, directly or indirectly injuring the navigability of said river systems, carried on in said territory other than as permitted under the provisions of this act is hereby prohibited and declared unlawful.

Injurious hydraulic mining prohibited.

Duty of commission. Plans.

SEC. 4. That it shall be the duty of said commission to mature and adopt such plan or plans, from examinations and surveys already made and from such additional examinations and surveys as it may deem necessary, as will improve the navigability of all the rivers comprising said systems, deepen their channels, and protect their banks. Such plan or plans shall be matured with a view of making the same effective as against the encroachment of and damage from debris resulting from mining operations, natural erosion, or other causes, with a view of restoring, as near as practicable and the necessities of commerce and navigation demand, the navigability of said rivers to the condition existing in eighteen hundred and sixty, and permitting mining by the hydraulic process, as the term is understood in said state, to be carried on, provided the same can be accomplished without injury to the navigability of said rivers or the lands adjacent thereto.

Improving navigability of rivers, etc.

Certain hydraulic mining permitted.

Surveys of storage sites for debris, reservoirs, etc.

SEC. 5. That it shall further examine, survey, and determine the utility and practicability, for the purposes hereinafter indicated, of storage sites in the tributaries of said rivers and in the respective branches of said tributaries, or in the plains, basins, sloughs, and tule and swamp lands adjacent to or along the course of said rivers, for the storage of debris or water or as settling reservoirs, with the object of using the same by either or all of these methods to aid in the improvement and protection of said navigable rivers by preventing deposits therein of debris resulting from mining operations, natural erosion, or other causes, or for affording relief thereto in flood time and providing sufficient water to maintain scouring force therein in the summer season; and in connection therewith to investigate such hydraulic and other mines as are now or may have been worked by methods intended to restrain the debris and material moved in operating such mines by impounding dams, settling reservoirs, or otherwise, and in general to make such study of and researches in the hydraulic mining industry as science, experience, and engineering skill may suggest as practicable and useful in devising a method or methods whereby such mining may be carried on as aforesaid.

Examination of hydraulic and other mines, etc.

Noting condition of navigable channels.

SEC. 6. That the said commission shall from time to time note the conditions of the navigable channels of said river systems, by cross-section surveys or otherwise, in order to ascertain the effect therein of such hydraulic mining operations as may be permitted by its orders and such as is caused by erosion, natural or otherwise.

Annual report.

SEC. 7. That said commission shall submit to the Chief of Engineers, for the information of the Secretary of War, on or before the fifteenth day of November of each year, a report of its labors and transactions, with plans for the construction, completion, and preservation of the public works outlined in this act, together with estimates of the cost thereof, stating what amounts can be profitably expended thereon each year. The Secretary of War shall thereupon submit same to Congress on or before the meeting thereof.

Contents.

"Hydraulic mining" and "mining by the hydraulic process" defined.

SEC. 8. That for the purposes of this act "hydraulic mining" and "mining by the hydraulic process," are hereby declared to have the meaning and application given to said terms in said State

Hydraulic miners must file petition with commission.

SEC. 9. That the individual proprietor or proprietors, or in case of a corporation, its manager or agent appointed for that purpose, owning mining ground in the territory in the State of California mentioned in section three hereof, which it is desired to work by the hydraulic process, must file with said commission a verified petition, setting forth such facts as will comply with law and the rules prescribed by said commission.

Surrender to United States of right to regulate the working, etc.

SEC 10 That said petition shall be accompanied by an instrument duly executed and acknowledged, as required by the law of the said State, whereby the owner or owners of such mine or mines surrender to the United States the right and privilege to regulate by law, as provided in this act, or any law that may hereafter be enacted, or by such rules and regulations as may be prescribed by virtue thereof, the manner and method in which the debris resulting from the working of said mine or mines shall be restrained, and what amount shall be produced therefrom; it being understood that the surrender aforesaid shall not be construed as in any way affecting the right of such owner or owners to operate said mine or mines by any other process or method now in use in said State: *Provided*, That they shall not interfere with the navigability of the aforesaid rivers.

Use of other processes, etc., not affected.

Proviso.
Navigability of rivers.

Joint petition by mining claim owners requiring a common dumping ground, etc.

SEC 11. That the owners of several mining claims situated so as to require a common dumping ground or dam or other restraining works for the débris issuing therefrom in one or more sites may file a joint petition setting forth such facts in addition to the requirements of section nine hereof; and where the owner of a hydraulic mine or owners of several such mines have and use common dumping sites for impounding débris or as settling reservoirs, which sites are located below the mine of an applicant not entitled to use same, such fact shall also be stated in said petition. Thereupon the same proceedings shall be had as provided for herein.

Notice of petition, etc., to be published.

SEC. 12. A notice specifying briefly the contents of said petition and fixing a time previous to which all proofs are to be submitted shall be published by said commission in some newspaper or newspapers of general circulation in the communities interested in the matter set forth therein. If published in a daily paper such publication shall con-

tinue for at least ten days; if in a weekly paper in at least three issues of the same. Pending publication thereof said commission, or a committee thereof, shall examine the mine and premises described in such petition. On or before the time so fixed all parties interested, either as petitioners or contestants, whether miners or agriculturists, may file affidavits, plans, and maps in support of their respective claims. Further hearings, upon notice to all parties of record, may be granted by the commission when necessary.

Examination pending publication.

Affidavits, plans, etc., may be filed.

Hearings.

Favorable decisions within thirty days.

SEC. 13. That in case a majority of the members of said commission, within thirty days after the time so fixed, concur in a decision in favor of the petitioner or petitioners, the said commission shall thereupon make an order directing the methods and specifying in detail the manner in which operations shall proceed in such mine or mines; what restraining or impounding works, if facilities therefor can be found, shall be built, and maintained; how and of what material; where to be located; and in general set forth such further requirements and safeguards as will protect the public interests and prevent injury to the said navigable rivers, and the lands adjacent thereto, with such further conditions and limitations as will observe all the provisions of this act in relation to the working thereof and the payment of taxes on the gross proceeds of the same: *Provided*, That all expense incurred in complying with said order shall be borne by the owner or owners of such mine or mines.

Order directing methods of mining, conditions, etc.

Taxes on gross proceeds.

Proviso.

Expenses.

Plans, etc., to be submitted to commission.

SEC. 14. That such petitioner or petitioners must within a reasonable time present plans and specifications of all works required to be built in pursuance of said order for examination, correction, and approval by said commission; and thereupon work may immediately commence thereon under the supervision of said commission or representative thereof attached thereto from said Corps of Engineers, who shall inspect same from time to time. Upon completion thereof, if found in every respect to meet the requirements of the said order and said approved plans and specifications, permission shall thereupon be granted to the owner or owners of such mine or mines to commence mining operations, subject to the conditions of said order and the provisions of this act.

Commencement of works.

Supervision and inspection.

Completion of works.

Permission to commence mining.

Conditions, etc., as to commencing operations.

SEC. 15. That no permission granted to a mine owner or owners under this act shall take effect, so far as regards the working of a mine, until all impounding dams or other restraining works, if any are prescribed by the order granting such permission, have been completed and until the impounding dams or other restraining works or settling reservoirs provided by said commission have reached such a stage as, in the opinion of said commission, it is safe to use the same: *Provided, however*, That if said commission shall be of the opinion that the restraining and other works already constructed at the mine or mines shall be sufficient to protect the navigable rivers of said systems and the work of said commission, then the owner or owners of such mine or mines may be permitted to commence operations.

Proviso.

Navigation, etc., sufficiently protected.

Allotment of expenses for constructing common dumps, etc.

SEC. 16. That in case the joint petition referred to in section eleven hereof is granted, the commission shall fix the respective amounts to be paid by each owner of such mines toward providing and building necessary impounding dams or other restraining works. In the event of a petition being filed after the entry of such order, or in case the impounding dam or dams or other restraining works have already been constructed and accepted by said commission, the commission shall fix such amount as may be reasonable for the privilege of dumping therein, which amount shall be divided between the original owners of such impounding dams or other restraining works in proportion to the amount respectively paid by each party owning same. The expense of maintaining and protecting such joint dam or works shall be divided among mine-owners using the same in such proportion as the commission shall determine. In all cases where it is practicable, restraining and impounding works are to be provided, constructed, and maintained by mine-owners near or below the mine or mines before reaching the main tributaries of said navigable waters.

Subsequent petitioners to pay for dumping privilege.

Apportionment of such payment to original owners.

Maintenance, etc.

Location.

Limit of débris washed away.

SEC. 17. That at no time shall any more débris be permitted to be washed away from any hydraulic mine or mines situated on the tributaries of said rivers and the respective branches of each, worked under the provisions of this act, than can be impounded within the restraining works erected.

Modification, etc., of orders.

SEC. 18. That the said commission may at any time, when the condition of the navigable rivers or when the capacities of all impounding and settling facilities erected by mine-owners or such as may be provided by Government authority require same, modify the order granting the privilege to mine by the hydraulic mining process so as to reduce amount thereof to meet the capacities of the facilities then in use, or, if actually required in order to protect the navigable rivers from damage, may revoke same until the further notice of the commission.

Forfeiture for violating conditions.

SEC. 19. That an intentional violation on the part of a mine owner or owners, company, or corporation, or the agents or the employees of either, of the conditions of the order granted pursuant to section thirteen, or such modifications thereof as may have been made by said commission, shall work a forfeiture of the privileges thereby conferred, and upon notice being served by the order of said commission upon such owner or owners, company or corporation, or agent in charge, work shall immediately cease. Said commission shall take necessary steps to enforce its orders in case of the failure, neglect, or refusal of such owner or owners, company, or corporation, or agents thereof, to comply therewith, or in the event of any person or persons, company, or corporation working by said process in said territory contrary to law.

Work to cease upon service of notice.

Enforcement of orders, etc.

Visiting mines.

SEC. 20. That said commission, or a committee therefrom, or officer of said corps assigned to duty under its orders, shall, whenever deemed necessary, visit said territory and all mines operating under the provisions of this act. A report of such examination shall be placed on file.

Report.

Use of public lands and materials.

SEC. 21. That the said commission is hereby granted the right to use any of the public lands of the United States, or any rock, stone, timber, trees, brush, or material thereon or therein, for any of the purposes of this act; and the Secretary of the Interior is hereby authorized and requested, after notice has been filed with the Commissioner of the General Land Office by said commission, setting forth what public lands are required by it under the authority of this section, that such land or lands shall be withdrawn from sale and entry under the laws of the United States.

Withdrawal of lands from sale and entry.

Willfully injuring works a misdemeanor.

SEC. 22. That any person or persons who wilfully or maliciously injure, damage, or destroy, or attempt to injure, damage, or destroy, any dam or other work erected under the provisions of this act for restraining, impounding, or settling purposes, or for use in connection therewith, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not to exceed the sum of five thousand dollars, or be imprisoned not to exceed five years, or by both such fine and imprisonment, in the discretion of the court. And any person or persons, company or corporation, their agents or employees, who shall mine by the hydraulic process directly or indirectly injuring the navigable waters of the United States, in violation of the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding five thousand dollars, or by imprisonment not exceeding one year, or by both such fine and imprisonment, in the discretion of the court: *Provided*, That this section shall take effect on the first day of May, eighteen hundred and ninety-three.

Penalty.

Violation of this act a misdemeanor.

Penalty.

Proviso.

Operative date.

Tax on gross proceeds of hydraulic mines.

SEC. 23. That upon the construction by the said commission of dams or other works for the detention of debris from hydraulic mines and the issuing of the order provided for by this act to any individual, company, or corporation to work any mine or mines by hydraulic process, the individual, company, or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in whole or in part restrained by such dams or other works erected by said commission, shall pay a tax of three per centum on the gross proceeds of his, their, or its mine so worked; which tax of three per centum shall be ascertained and paid in accordance with regulations to be adopted by the Secretary of the Treasury, and the Treasurer of the United States is hereby authorized to receive the same. All sums of money paid into the Treasury under this section shall be set apart and credited to a fund to be known as the "Debris Fund," and shall be expended by said commission under the supervision of the Chief of Engineers and direction of the Secretary of War, in addition to the appropriations made by law in the construction and maintenance of such restraining works and settling reservoirs as may be proper and necessary: *Provided*, That said commission is hereby authorized to receive and pay into the Treasury from the owner or owners of mines worked by the hydraulic process,

Ascertainment and payment of tax.

Regulations, etc.

A "Debris Fund" created.

Expenditures from same by the commission.

Provisos.

Money advances from mine-owners.

to whom permission may have been granted so to work under the provisions thereof, such money advances as may be offered to aid in the construction of such impounding dams or other restraining works, or settling reservoirs, or sites therefor, as may be deemed necessary by said commission to protect the navigable channels of said river systems, on condition that all moneys so advanced shall be refunded as the said tax is paid into the said debris fund: *And provided further*, That in no event shall the Government of the United States be held liable to refund same except as directed by this section.

Refund of same when tax is paid.

Limitation.

SEC. 24. That for the purpose of securing harmony of action and economy in expenditures in the work to be done by the United States and the State of California, respectively, the former in its plans for the improvement and protection of the navigable streams and to prevent the depositing of mining debris or other materials within the same, and the latter in its plans authorized by law for the reclamation, drainage, and protection of its lands, or relating to the working of hydraulic mines, the said commission is empowered to consult thereon with a commission of engineers of said State, if authorized by said State for said purpose, the result of such conference to be reported to the Chief of Engineers of the United States Army, and if by him approved shall be followed by said commission.

Commission may consult with State commission of engineers.

Report on conference.

Approval.

SEC. 25. That said commission, in order that such material as is now or may hereafter be lodged in the tributaries of the Sacramento and San Joaquin River systems resulting from mining operations, natural erosion, or other causes, shall be prevented from injuring the said navigable rivers or such of the tributaries of either as may be navigable and the land adjacent thereto, is hereby directed and empowered, when appropriations are made therefor by law, or sufficient money is deposited for that purpose in said debris fund, to build at such points above the head of navigation in said rivers and on the main tributaries thereof, or branches of such tributaries, or at any place adjacent to the same, which in the judgment of said Commission, will effect said object (the same to be of such material as will insure safety and permanency), such restraining or impounding dams and settling reservoirs, with such canals, locks, or other works adapted and required to complete same. The recommendations contained in Executive Document Numbered Two hundred and sixty-seven, Fifty-first Congress, second session, and Executive Document Numbered Ninety-eight, Forty-seventh Congress, First session, as far as they refer to impounding dams, or other restraining works, are hereby adopted, and the same are directed to be made the basis of operations. The sum of fifteen thousand dollars is hereby appropriated, from moneys in the Treasury not otherwise appropriated, to be immediately available to defray the expenses of said Commission.

Appropriations from debris fund to be expended in restraining works, etc., above head of navigation, etc.

Recommendations adopted and made the basis of operations.

Appropriations.

Approved, March 1, 1893.

[illegible] CHAP. 188.—An act authorizing the Saint Louis and Madison [illegible] to construct a bridge over the Mississippi River.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby given to the Saint Louis and Madison Bridge Transfer Company, a corporation created by the laws of the State of Illinois, or its successors or assigns, to build a bridge as hereinafter described, and maintain the same across the Mississippi River immediately adjoining and south of the Merchants' Bridge, at Saint Louis, Missouri. Said bridge hereby authorized shall be constructed to provide for the passage of street cars, wagons and vehicles, and for the transit of animals and foot passengers, for such reasonable rates of toll as may be prescribed by said company and approved by the Secretary of War.

Bridge may be built.

Rates of toll.

Bridge a lawful structure.

Sec. 2. That any bridge built under this act shall be a lawful structure over which and its approaches may be maintained the mails, the troops, and the munitions of war of the United States free of charge; and the United States shall have the right of way for postal telegraph purposes across said bridge; and said bridge shall enjoy the privileges of other post roads in the United States, and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies: *Provided,* That all street railway companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of street railway cars over the same and over the approaches to the same upon the payment of a reasonable compensation for such use, and in case the owner or owners of said bridge and the several street railway companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon the rules and conditions to which each shall conform in using said bridge all matters at issue between them shall be decided by the Secretary of War upon a hearing of the [illegible] and proofs of the parties.

Mails, troops, etc.

Free of charge.

Postal telegraph.

Other post roads.

Equal privileges.

Proviso.

Use of bridge by street railway companies.

Terms.

Construction.

Spans.

Sec. 3. That said bridge shall be made of unbroken and continuous spans of the same length as those of the Saint Louis Merchants' Bridge, built under the act approved February third, eighteen hundred and eighty-seven, with the same clear height above the water, and resting upon piers placed in the same lines as those of the said Merchants' Bridge as now built.

Vol. 24, p. 375.

Piers.

Unobstructed navigation.

Sec. 4. That riprapping or other protection for imperfect foundations which will materially lessen the waterways shall not be employed in the channel ways of the high spans, and piers which will produce cross currents or bars dangerous to navigation shall not be constructed; and if, after construction, any piers or protection walls are found to produce the above-mentioned effects the nuisance shall be abated or corrected by the owners of said bridge.

Aids to navigation.

Sec. 5. That in case the approaches to the channel span in said bridge be found dangerous or difficult of access by any important class of river traffic, the Secretary of War

shall order the construction of such sheer booms, guide piers, or other similar devices as will obviate the difficulty, which sheer boom, guide pier, or other device shall be paid for by the person owning or operating said bridge.

Lights, etc.

SEC. 6. That the persons owning, controlling, or operating the bridge authorized by this act shall maintain, at their own expense, from sunset to sunrise, throughout the year and during heavy fogs, such lights or other signals as the Light-House Board shall prescribe, and shall, during the season of navigation, have posted in a conspicuous place on or near the bridge the clear headroom under the channel span on that day, the figure expressing this height to be not less than two feet high, and to be readily visible from any point in the channel of the river for a stretch of three thousand feet above the bridge and one thousand feet below the bridge.

Free navigation.

SEC. 7. That no bridge shall be erected or maintained under authority of this act which shall at any time substantially or materially obstruct the free navigation of said river, and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of such bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the persons owning or controlling said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the circuit courts of the United States of Illinois or Missouri in whose jurisdiction any portion of said bridge may be located.

Structural changes.

Litigation.

Secretary of War to approve plans, etc.

SEC. 8. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge and a map of the location, giving, for the space of one mile above and one mile below the proposed location of the bridge, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the current at low, medium, and high-water stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any changes be made in the plan of said bridge during the progress of construction such changes shall be subject to the approval of the Secretary of War.

Changes.

Commencement and completion.

SEC. 9. That in case the construction of the bridge authorized in this act be not commenced within one year and completed within three years from the date of its approval then this act shall be null and void.

Amendment, etc.
Proviso.
Limit of location.

SEC. 10. That the right to alter, amend, or repeal this act is hereby expressly reserved. And it is further provided that no bridges shall be constructed across the Mississippi River within two miles above or two miles below the bridge herein provided for, unless authorized by Congress, and the plans therefor approved by the Secretary of War.

Approved March 1, 1893.

March 1, 1893.
Vol. 27, p. 513.

CHAP. 185.—An act to authorize the construction of a bridge across the Calumet River.

Calumet and Blue Island Railway Company may bridge Calumet River, in Cook County, Ill.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Calumet and Blue Island Railway Company, a corporation organized and existing under the laws of the State of Illinois, or its successors and assigns, to construct and maintain a bridge and approaches thereto across the Calumet River, in Cook County, in the State of

Location.

Illinois, at a point on and opposite that part of lot one, in block sixty-three, lying south of block sixty-two and east of an imaginary line drawn south from the southwest corner of block sixty-two to the river Calumet, of the subdivision of sections five and six, township thirty-seven north, range fifteen east, of the third principal meridian;

Railway bridge.

that said bridge may be constructed for railway and postal service, with single or double track for railway traffic, and which shall be under the conditions and limitations hereinafter specified.

Free navigation.

SEC. 2. That said bridge shall not interfere with the free navigation of said river beyond what may be necessary to carry into effect the rights and privileges herein granted, and in case of any litigation arising under the provisions

Litigation.

of this act such litigation may be tried and determined by the circuit court of the United States within whose jurisdiction said bridge is located.

Lawful structure and post route.

SEC. 3. That any bridge built under the provisions of this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for

Charges for passengers, freight, etc.

the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over the said bridge, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post roads in the United States; and the United States shall have the right

Postal telegraph.

of way across said bridge and its approaches for postal-telegraph purposes, and all telegraph and telephone compa-

Use by telegraph, etc., companies.

nies shall have equal rights and privileges in constructing and maintaining their lines across said bridge.

Construction.

SEC. 4. That said bridge shall be constructed as a draw-bridge of such character of construction and having such

Draw.

width of draw-openings and such elevation above high water as the Secretary of War may prescribe; and the

draw openings of said bridge shall be so protected and arranged that water crafts can be worked through them at any and all times; and the piers of said bridge shall be parallel with and the bridge itself at right angles to the current of the river: *Provided*, That said draw shall be opened promptly upon reasonable signals for the passage of boats; and said company or corporation shall maintain, at its own expense, from sunset until sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe. If any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the cause may be brought in the circuit court of the United States for the State of Illinois in whose jurisdiction any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers or exempt this bridge from the operation of the same.

Provisos.
Opening draw.
Lights, etc.
Unobstructed navigation.
Litigation.
Existing laws not affected.

SEC. 5. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and the proofs of the parties.

Use by other railroad companies.
Terms.

SEC. 6. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigations of said river as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War for his examination and approval a design and drawing of the bridge, and a map of location giving, for the space of one-half mile above and one-half mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the directions and strength of currents at all stages, and soundings accurately showing the bed of the stream, and the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and when said plan is approved said company may proceed to the erection of said

Secretary of War to approve plans, etc.

Alterations.

bridge. The Secretary of War may make such alterations in such plans as he may deem necessary to the better protection of navigation, and such alterations shall be adopted by the said railway company. The said railway company may at any time make any alterations deemed advisable to be made in said bridge, but must first submit such proposed alterations to the Secretary of War, and his approval shall be first had before they shall be authorized or made; the cost of such change shall be paid by the company owning or controlling said bridge.

Amendment, etc.

SEC. 7. That the right to alter or amendor reappeal this act is hereby expressly reserved.

Commencement and completion.

SEC. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Approved, March 1, 1893.

March 1, 1893. Vol. 27, p. 515.

CHAP. 186.—An act making appropriations for the support of the Military Academy for the fiscal year ending June thirtieth, eighteen hundred and ninety-four.

Military Academy appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the support of the Military Academy for the fiscal year ending June thirtieth, eighteen hundred and ninety-four:

Pay of superintendent, professors, etc.

For pay of one superintendent of the United States Military Academy (colonel), in addition to pay as lieutenant-colonel of engineers, five hundred dollars.

* * * * * * *

For pay of one instructor of practical military engineering (major), in addition to pay as captain, five hundred dollars.

* * * * * * *

Department of civil and military engineering.

For department of civil and military engineering: For models, maps, purchase and repair of instruments, textbooks, books of reference and stationery for the use of instructors, and contingencies, one thousand five hundred dollars;

For extra pay of one enlisted man employed as draftsman, two hundred and fifty-six dollars;

In all, one thousand seven hundred and fifty-six dollars.

* * * * * * *

Department of practical military engineering.

For department of practical military engineering: For purchase and repair of instruments, transportation, purchase of tools, implements, and materials, and for extra duty pay of engineer soldiers, as follows, namely: For instruments for use in instructing cadets, in making reconnaissances; photographic apparatus and material for field photography; drawing instruments and material for platting reconnaissances, surveying instruments, instruments

and material for signaling and field telegraphy; transportation of field parties; tools and materials for the preservation, augmentation, and repair of wooden ponton and one canvas ponton bridge train, sapping and mining tools and material; rope, cordage, material for rafts and for spar and trestle bridges; intrenching tools, tools and material for the repair of Fort Clinton and the batteries at the academy, and extra-duty pay of engineer soldiers, at fifty cents per day each, when performing special skilled mechanical labor in the department of practical military engineering; for models, books of reference, and stationery, one thousand two hundred dollars.

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Approved, March 1, 1893.

CHAP. 190.—An act to authorize the Montgomery Bridge Company to construct and maintain a bridge across the Alabama River near the city of Montgomery, Alabama.

March 1, 1893.
Vol. 27, p. 528.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Montgomery Bridge Company, a corporation created and existing under an act of the general assembly of the State of Alabama, for the purpose of constructing and maintaining the bridge hereinafter mentioned, be, and is hereby, authorized to construct and maintain a wagon bridge for the passage of vehicles, foot passengers, and animals across the Alabama River, at such point as may be selected by such company between the junction of the Coosa and Tallapoosa rivers and the city of Montgomery, in the State of Alabama, said bridge to be so constructed as not to obstruct the navigation af said river and to be provided with a suitable draw: *Provided*, That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post route, and the same is hereby declared to be a post route, and the United States shall have the right of way for a postal telegraph across said bridge.

Montgomery Bridge Company may bridge Alabama River near Montgomery, Ala.

Wagon bridge, etc.

Draw.
Proviso.

Lawful structure and post route.

Postal telegraph.

SEC. 2. That the bridge authorized to be constructed under this act shall be located and built under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the proposed bridge and a map of the location, giving, for the space of one-half mile above and one-half mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the currents, and the soundings, accurately showing the bed of the stream, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War no work upon the bridge shall be commenced; and should any change be made

Secretary of War to approve plans, etc.

in the plan of said bridge during the progress of construction such change shall be subject to the approval of the Secretary of War.

Amendment, etc.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at any time; and that if at any time navigation of said river shall in any manner be obstructed or impaired by the said bridge, the Secretary of War shall have authority, and it shall be his duty, to require the said bridge company to alter and change the said bridge, at its own expense, in such manner as may be proper to secure free and complete navigation without impediment; and if, upon reasonable notice to said bridge company to make such change or improvements, the said company fails to do so, the Secretary of War shall have authority to make the same at the expense of said company, and all the rights conferred by this act shall be forfeited; and Congress shall have power to do any and all things necessary to secure the free navigation of the river.

Changes.

Forfeiture.

Free navigation.

Tolls.

SEC. 4. That said company shall be permitted to charge and take such rates of toll for crossing said bridge as may be reasonable, subject to the approval of the Secretary of War.

Opening draw.

SEC. 5. That the draw provided for the bridge herein authorized to be constructed shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Lights, etc.

Use by telegraph, etc., companies.

SEC. 6. That all telephone and telegraph companies shall be granted equal rights and privileges in the construction and operation of their lines across said bridge; and if actual construction of the bridge herein authorized shall not be commenced within one year from the passage of this act, and be completed within three years from same date, the rights and privileges hereby granted shall cease and be determined.

Commencement and completion.

Approved, March 1, 1893.

March 1, 1893.
Vol. 27, p. 529.

CHAP. 191.—An act to amend an act approved July twenty-seventh, eighteen hundred and ninety-two, entitled "An act to provide for the improvement of the outer bar of Brunswick, Georgia."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be authorized to pay to C. P. Goodyear, his heirs or assigns, upon the procurement by said C. P. Goodyear, his heirs or assigns, of a practicable channel over the outer bar of Brunswick, Georgia, at least one hundred feet in width, and of a minimum depth of twenty-two feet at ordinary mean high tide, on or before November first, eighteen hundred and ninety-three, the sum of ten thousand dollars; upon the procurement, as aforesaid, on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar of a

Brunswick, Ga.
Payments to C. P. Goodyear upon securing deep-water channel over outer bar.

Vol. 27, p. 280, amended.

Extension of time, etc.

minimum depth at ordinary mean high tide of twenty-three feet, ten thousand dollars more, to be paid in manner aforesaid; upon the procurement as aforesaid, on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar at a minimum depth at ordinary mean high tide of twenty-four feet, ten thousand dollars more, to be paid in manner aforesaid; upon the procurement as aforesaid on or before November first, eighteen hundred and ninety-three, of a depth of water in said channel over said outer bar of a minimum depth at ordinary mean high tide of twenty-five feet, ten thousand dollars more, to be paid in manner aforesaid; upon procurement, on or before November first, eighteen hundred and ninety-three, of a minimum depth in said channel over said outer bar of twenty-six feet at ordinary mean high tide, and of a width not less than one hundred and twenty five feet, ten thousand dollars more, to be paid in manner aforesaid; and should the depth of twenty five feet, at ordinary mean high tide in said channel over said outer bar, be procured on or before the time aforesaid, and maintained for two years for the width named thereafter, twenty-five thousand dollars in addition, to be paid in manner aforesaid; and should the depth of twenty six feet, at ordinary mean high tide for the width named, be procured on or before the date named, and maintained for two years thereafter, twenty-five thousand dollars in addition, to be paid in manner aforesaid. The said C. P. Goodyear, his heirs and assigns, shall perform said work on said outer bar by the explosion of dynamite on the bottom of said channel or sunk beneath the bottom of said channel, in his or their discretion, and not otherwise; and the channel to be deepened as aforesaid shall be north of the present buoyed-out channel, so that said work shall not interfere with the commerce of the port of Brunswick during the progress of such work. The Secretary of War shall detail an officer of engineers to examine and report upon said work from time to time, at such times as the said C. P. Goodyear, his heirs and assigns, announce that they have complied with the conditions as to any of the depths and widths named, or as to the maintenance, of depths of twenty-five and twenty-six feet, and payments to be made as aforesaid upon the certificate of such engineer that such depth and width, or such maintenance, has been accomplished in accordance with the provisions of this act. And said engineer officer shall specially report as to the means used to acquire and maintain said depths and widths. And the money necessary to carry out the provisions of this act is hereby reappropriated out of any money in the Treasury not otherwise appropriated.

Work to be done by exploding dynamite.

Engineer officer to report on maintenance, etc.

Special report on means used.

Reappropriation.

Approved, March 1, 1893.

March 2, 1893. Vol. 27, p. 532.

CHAP. 197.—An act to provide a permanent system of highways in that part of the District of Columbia lying outside of cities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Commissioners of the District of Columbia are hereby authorized and directed to prepare a plan for the extension of a permanent system of highways over all that portion of said District not included within the limits of the cities of Washington and Georgetown. Said system shall be made as nearly in conformity with the street plan of the city of Washington as the Commissioners may deem advisable and practicable. The highways provided in such plans shall not in any case be less than ninety feet nor more than one hundred and sixty feet wide, except in cases of existing highways, which may be established of any width not less than their existing width and not more than one hundred and sixty feet in width.

District of Columbia.
Permanent system of highways in, outside of cities.
Conforming to street plan of Washington.
Width.

SEC. 2. That the said plans shall be prepared from time to time in sections, each of which shall cover such an area as the Commissioners may deem advisable to include therein, and it shall be the duty of the Commissioners in preparing such plan by sections, as far as may be practicable, to select first such areas as are covered by existing suburban subdivisions not in conformity with the general plan of the city of Washington. The Commissioners in making such plans shall adopt and conform to any then existing subdivisions which shall have been made in compliance with the provisions of the act of Congress approved August twenty-seventh, eighteen hundred and eighty-eight, entitled "An act to regulate the subdivision of land within the District of Columbia," or which shall, in the opinion of the Commissioners, conform to the general plan of the city of Washington: *Provided, however,* That no place or street extending no farther than from one principal street to another, which has been opened under the direction of the Commissioners, or in conformity with any subdivision approved by them prior to August twenty-seventh, eighteen hundred and eighty-eight, and recorded, and which is now paved with asphalt or other sheet pavement, shall be altered, affected, or interfered with by any plan adopted or anything done under or by virtue of this act. Whenever the plan of any such section shall have been adopted by the Commissioners they shall cause a map of the same to be made showing the boundaries and dimensions of and number of square feet in the streets, avenues, and roads established by them therein; the boundaries and dimensions of and number of square feet in each, if any, of the then existing highways in the area covered by such map, and the boundaries and dimensions of and number of square feet in each lot of any then existing subdivision owned by private persons; and containing such explanations as shall be necessary to a complete understanding of such map. In making such maps the Commissioners are further authorized to lay out at the intersections of the principal avenues and streets thereof

Preparation of plans in sections.
Adoption of existing suburban subdivisions.
Vol. 25, p. 451.
Provisos.
Short asphalted streets not to be affected, etc.
Map.

circles or other reservations corresponding in number and dimensions with those now existing at such intersections in the city of Washington. A copy of such map, duly certified by the Commissioners, shall be delivered to a commission hereby created, composed of the Secretary of War, the Secretary of the Interior, and the Chief of Engineers, for the time being, who shall make such alterations, if any, therein, as they shall deem advisable, keeping in view the intention and provisions of this act, and the necessity of harmonizing as far as possible the public convenience with economy of expenditure; and if such commission shall see fit, they may cause to be made a new map in place of the one submitted to them. When such commission, or a majority thereof, shall have come to a final determination in the matter, they shall approve in writing the map which they shall adopt, and shall deliver it to said Commissioners of the District of Columbia, and the same shall at once be filed and recorded in the office of the surveyor of the District of Columbia, and after any such map shall have been so recorded no further subdivision of any land included therein shall be admitted to record in the office of the surveyor of said District, or in the office of the recorder of deeds thereof, unless the same be first approved by the Commissioners and be in conformity to such map. Nor shall it be lawful when any such map shall have been so recorded for the Commissioners of the District of Columbia, or any other officer or person representing the United States or the District of Columbia, to thereafter improve, repair, or assume any responsibility in regard to any abandoned highway within the area covered by such map, or to accept, improve, repair, or assume any responsibility in regard to any highway that any owner of land in such area shall thereafter attempt to lay out or establish, unless such landowner shall first have submitted to the Commissioners a plat of such proposed highway and the Commissioners shall have found the same to be in conformity to such map, and shall have approved such plat and caused it to be recorded in the office of said surveyor. In order to enable the said Commissioners to proceed speedily and efficiently to carry out the purposes of this act, they are hereby authorized to appoint two civilians assistants to the Engineer Commissioner, who, with such Engineer Commissioner shall, under the direction of the Commissioners, have immediate charge of the work to be done under this act: *Provided, however*, That the appointment, term of office, and compensation of such civilian assistants shall be subject to the approval of the commission hereinbefore provided for, consisting of the Secretary of War, the Secretary of the Interior, and the Chief of the Engineers, or of a majority of them.

Circles, etc., at street intersections.

Certified copies of maps, etc., to go to a commission.

Alterations, etc.

Determination and approval, etc.

Filing and recording.

No further subdivision to be recorded unless approved, etc.

Abandoned highways not to be improved, etc.

Projected highways subject to approval, etc., of District Commissioners.

Civilian assistants to Engineer Commissioner, etc., appointed in charge of work.

Appointments, etc.

SEC. 3. That when any such map shall have been recorded as aforesaid in the office of the surveyor of the District it shall be lawful for the owner of any land included within such map to adopt the subdivision thereby made by a reference thereto and to this section in any deed or will which he shall thereafter make, and when any deed or will containing any such reference shall have been made and

Deeds and wills.

recorded in the proper office it shall have the same effect as though the grantor or grantors in such deed or the maker of such will had made such subdivision and recorded the same in compliance with law.

Surveys for plans, etc.

SEC. 4. That for the purpose of making surveys for such plans and maps the Commissioners and their agents and employees necessarily engaged in making such surveys are authorized to enter upon any lands through or on which any projected highway or reservation may run or lie.

Naming of streets, etc.

SEC. 5. That the Commissioners of the District of Columbia are authorized to name all streets, avenues, alleys, and reservations laid out or adopted under the provisions of this act.

Condemnation proceedings.

SEC. 6. That within thirty days after any such map shall have been recorded as aforesaid, which shall alter any highway or highways in any then existing subdivision in the area included in such map, or which shall dispense with any highway or highways, or any part thereof, in any such subdivision, the Commissioners of the District of Columbia shall make application to the supreme court of the District of Columbia, holding a special term as a district court of the United States, by written petition, praying the condemnation of a permanent right of way for the public over all the land lying within the limits of such subdivision not already owned by the United States or the District of Columbia, or dedicated to public use as a highway, which shall be included within the highways or reservations laid out by the Commissioners and indicated on such map. Upon the filing of such petition the said court in special term shall proceed to condemn a permanent right of way for the public over said land in the manner hereinafter provided.

Highways not in existing subdivisions, etc.

SEC. 7. That as to any highway or highways or part of any highway or highways laid down upon any such map which shall not lie within the limits of any existing subdivision the Commissioners at any time thereafter, when in their judgment the public convenience shall require the

Petition, etc.

opening of the same or of any part thereof, may make application as aforesaid to the supreme court of the District of Columbia, holding a special term as aforesaid, for the condemnation and opening of the same; and said court in special term as aforesaid shall thereupon proceed in the manner hereinafter provided to condemn a permanent right of way for the public over all the land not already owned by the United States or the District of Columbia, or dedicated to public use as a highway, included within the highway or highways or part of a highway or highways described in such application: *Provided*, That in such case

Provisos.

Hearings, etc.

the court, after public notice shall have been given as hereinafter directed, shall first hear evidence as to whether the public convenience does in fact require the immediate opening of the highway or highways or part of any highway or highways described in such application, and shall deter-

Determination, etc.

mine that question on the evidence submitted to it; and if the court shall as to any part of the land sought to be condemned decide such question in the negative it shall pro-

ceed no further as to such part at that time. And if the court, after such notice and hearing, shall determine that the public convenience does not in fact require the immediate opening of any highway or highways or any part thereof described in such application; no further proceedings shall be had under such application. Further proceedings.

SEC. 8. That when any application shall have been filed in said court in special term under the preceding sections of this act said court in special term shall cause public notice of not less than thirty days to be given of such application, in such manner as shall be prescribed by a general rule by said court in general term, which notice shall warn all persons having any interest in the proceedings to attend the court at a day to be named in said notice, and to continue in attendance until the court shall have made a final order in the premises. Said court in special term, after such notice shall have been given, shall take no further step until the time thereby limited shall have expired, and shall afford all parties in interest a reasonable opportunity to be heard during the proceedings. In addition to such public notice said court in special term, whenever it shall be practicable to do so, shall cause a similar notice to be served by the marshal of the District of Columbia, or his deputies, upon each of the owners of the land sought to be condemned; and shall also cause notice to be given to the attorney of the United States for the District of Columbia. Public notice of application. Hearing, etc. Service of notice.

SEC. 9. That when the object of any such application to said court shall be in whole or in part to rectify or change an existing subdivision the court, immediately after the expiration of the time limited in such notice, shall proceed without delay to make the required condemnation, so far as it shall relate to any land within such subdivision, and as to any land not lying within the limits of an existing subdivision which is sought to be rectified or changed the court shall proceed in like manner only after it shall have determined as hereinbefore provided that the public convenience requires the condemnation, and then only to the extent which the public convenience shall require. Condemnation.

SEC. 10. That when any right of way is to be condemned under this act said court in special term shall cause a jury of seven judicious, disinterested men, not related to any person interested in the proceedings, and not in the service or employment of the District of Columbia or of the United States, to be summoned by the marshal, and shall administer to the jury an oath or affirmation that they will, without favor or partiality to anyone, to the best of their judgment, determine such questions as may be submitted to them by the court during the proceedings. The court, before accepting the jury, shall hear any objections that may be made to any member thereof, and shall have full power to decide on all such objections and to excuse any juror and to cause any vacancies in the jury to be filled. When the jury shall have been organized the court and the jury shall hear and receive such evidence as may be offered or submitted on behalf of the District of Columbia or on behalf of the United States or by any person having any interest in Jury. Composition. Oath. Objections to jurors. Hearing.

Procedure. the proceedings, and the proceedings shall be conducted as nearly as may be as civil cases triable by jury are now conducted in said District, but the order of proof shall be in the discretion of the court. Upon the motion of any party in interest the court may direct the jury to view the premises under consideration, under such regulations as the court may prescribe. When the hearing is concluded the jury, or a majority thereof, shall render a written verdict in such form as may be prescribed or submitted to the jury by the court, which verdict shall be signed by the jurors, or by a majority of them, and filed in the court. The court shall have power to set aside such verdict when satisfied that the same is unjust or unreasonable. One jury may be sworn and one trial had as to all or any of the parcels of land involved in the proceeding, at the discretion of the court, and where the jury shall have rendered a verdict as to more than one parcel of land the court may set aside the verdict as to one or more parcels and confirm it as to the others. When the verdict of the jury, in whole or in part, shall have been so set aside a new jury shall be summoned and the proceedings continued until the court shall have confirmed a verdict as to all the land involved in the proceeding.

Order of proof, etc.

Written verdict.

May be set aside.

Powers of the court as to trials, juries, verdicts, etc.

Confirmation.

Damage where part only of tract condemned.

SEC. 11. That where the use of a part only of any parcel or tract of land shall be condemned in such a proceeding the jury in assessing the damages therefor shall take into consideration the benefit the purpose for which it is taken may be to the owner or owners of such tract or parcel by enhancing the value of the remainder of the same, and shall give their verdict accordingly, and the court may require in such case that the damages and the benefits shall be found and stated separately.

Death, etc., of juror.

Hearing to proceed.

Proviso.

Validity of verdict.

SEC. 12. That no trial under this act shall fail by reason of the death or disability of any juror occurring during the proceedings, but the hearing shall proceed with the remaining jurors: *Provided*, That no verdict shall be valid unless concurred in by a majority of a complete jury.

Evidence.

SEC. 13. That no evidence shall be offered or received by the jury as to the persons who will be entitled to receive the compensation that may be awarded as to any parcel of land. If any question shall arise as to whether any person claiming a right to be heard is in fact interested in the proceedings, the court shall hear and determine the question in a summary way, and in cases of doubt shall permit the party to be heard. The verdict of the jury shall state as to each parcel of land involved in the proceeding only the amount of compensation, less the benefits, if any, which it shall award in respect thereof, and shall not contain any finding as to the ownership of the land or the persons entitled to the compensation.

Contents of verdict.

Compensation of jurors.

SEC. 14. That each of said jurors shall receive a compensation of five dollars per day for his services during the time he shall be actually engaged in such services.

Damages to be equally assessed on benefited lands and District revenues.

SEC. 15. That the amount awarded by said court as damages for each highway or reservation, or part thereof, condemned and established under this act, shall be one half assessed against the land benefited thereby and the other

half shall be charged up to the revenues of the District of Columbia; that one-half of the amount awarded by said court as damage for each highway or reservation or part thereof, condemned and established under this act, shall be charged upon the lands benefited by the laying out and opening of such highway or reservation or part thereof and the remainder of said amount shall be charged to the revenues of the District of Columbia. The same jury which shall assess the damages caused by the opening of any highways or reservation or part thereof, or by the abandonment of an existing highway or part thereof, shall ascertain and determine what property is thereby benefited, and shall assess against each parcel which it shall find to be so benefited its proper proportional part of the whole of said one-half of the damages: *Provided*, That in making such assessment for benefits the jury shall, as to any tract a part of which shall have been taken for such highway or reservation, or part thereof, make due allowance for the amount, if any, which shall have been deducted from the value of the part taken on account of the benefit to the remainder of the tract. The proceedings of the court and the jury in making assessments for benefits under this section shall conform as nearly as is practicable to the foregoing provisions of this act relating to the assessment of damages, and the verdict of the jury making an assessment under this section as to any parcel of land shall not be conclusive until the same shall have been confirmed by the court. When confirmed by the court the assessment so made shall be a lien upon the land assessed, and shall be collected as special improvement taxes in the District of Columbia have been collected since February twenty-first, eighteen hundred and seventy-one, and shall be payable in five equal annual installments, with interest at the rate of four per centum per annum from the date of the confirmation of the assessment by the court. That no expense for the improvement of any street, circle, reservation or avenue laid out under the provisions of this act, outside the cities of Washington and Georgetown, shall be chargeable to the Treasury of the United States, but such expense shall be paid solely out of the revenues of the District of Columbia.

Damages and benefits to be found by same jury, etc.

Proviso.

Proceedings in assessing benefits to conform to those assessing damages, etc.

Confirmation of verdict by the court.

Assessment a lien upon land.

Collection.

Payable in installments.

Interest.

Improvement of streets, etc., outside of city lines, chargeable to District revenues only.

SEC. 16. That when said court shall have assessed the damages to be paid as to any parcel of land the use of which shall have been condemned, or which shall have been injured by the abandonment of a previously existing highway, and there shall be no controversy as to the persons who are entitled to receive the same or as to the distribution of the same among them, said court shall decree such payment to be made, and upon presentation of a duly certified copy of such decree to the Treasurer of the United States he shall report the same to Congress for consideration and action and shall make such payment to the person or persons appearing by such decree to be entitled thereto as Congress may provide; but where any such controversy shall exist or where there shall be any doubt as to the proper disposition of the compensation awarded, the court

Distribution of damages.

Where no controversy as to distribution, etc.

Where there is controversy, etc.

Payment into court.

shall order that the damages assessed by it involved in such controversy or doubt shall be paid into the registry of the court, and upon the presentation of a duly certified copy of such order to the Treasurer of the United States he shall, when the necessary money is appropriated, pay the amount therein mentioned to the clerk of said court; and the claims of the respective parties thereto shall thereupon be heard and decided by the court as in interpleader suits in equity, under such general rules as may be prescribed by said court in general term.

Hearing of contending claims, etc.

Questions of law certified to court in general term.

SEC. 17. That said court, in special term as aforesaid, may certify to said court in general term for decision there in the first instance any question of law that shall arise during any proceeding in said court in special term under this act. Any party aggrieved by the final order or decree of said court in special term fixing the amount of damages or the assessment for benefits as to any parcel of land may take an appeal therefrom to said court in general term, and shall be entitled to a bill of exceptions as in civil cases, triable by jury in said court, and said court in general term may affirm, reverse, or modify the order or decree appealed from: *Provided*, That said court in general term shall consider only questions of law arising on such appeal. From a final decree of said court in special term under this act distributing the damages among contending claimants any party aggrieved may in like manner take an appeal to the court in general term, which in such cases shall consider both questions of law and of fact. Any appeal under this act shall be taken within twenty days after the making of the final order or decree appealed from, and not afterwards, and shall be subject to existing laws and rules of court regulating appeals to said court in general term. Cases arising under this act shall have precedence over all other business in said court in special term, and shall have precedence in said court in general term over all other cases except criminal cases, and the decision of said court in general term upon any question arising under this act shall be final.

Appeals.

Proviso.

Limitation.

Final decision.

Possession to be enforced by process.

SEC. 18. That whenever any final decree shall have been made by said court under the provisions of this act for the payment of the damages to the parties or into the registry of the court and when the money has been appropriated and paid the Commissioners shall be entitled to take immediate possession of the parcel of land in regard to which said order of payment shall have been made, and the court shall enforce such right of possession by proper order and by process addressed to the marshal of the United States for the District of Columbia. In case the court shall enter judgment of condemnation in any case, and appropriation is not made by Congress for the payment of such award within the period of six months, Congress being in session for that time after such award or for the period of six months after the meeting of the next session of Congress, the proceedings shall be void, and the land shall revert to the owners.

In certain cases proceedings voided and land reverts.

SEC. 19. That the Commissioners of the District of Columbia shall include in their annual report a full statement of their action under this act, and shall submit annual estimates of the expenditures necessary to be made under its provisions, as other estimates are submitted. Report and estimates by District Commissioners.

Approved, March 2, 1893.

CHAP. 199.—An act making appropriations for the expenses of the government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, and for other purposes. March 3, 1893. Vol. 27, p. 537.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the half of the following sums named, respectively, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, and the other half out of the revenues of the District of Columbia, for the purposes following, being for the expenses of the government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, namely: District of Columbia appropriations. Half from District revenues.

GENERAL EXPENSES.

General expenses.

FOR SALARIES AND CONTINGENT EXPENSES.

Salaries, etc.

FOR EXECUTIVE OFFICE. For * * * one Engineer Commissioner, one thousand seven hundred and sixty-eight dollars (to make salary five thousand dollars); Executive office. Commissioners, secretary, etc.

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WASHINGTON AQUEDUCT.

Aqueduct.

For engineering, maintenance, and general repairs, twenty thousand dollars: *Provided*, That no portion of the water conveyed or to be conveyed through or by means of the Washington Aqueduct, or any appurtenance thereof, shall be diverted to the supply or use of any building, premises, or establishment located outside of the existing limits of the District of Columbia. Engineering, etc. *Proviso.* Diversion of water prohibited.

Towards improving thee receiving reservoir by the works required for cutting off the drainage into it of polluted waters and sewage from the surrounding country, for the purchase or condemnation of the small amount of land required for the purpose, and for the excavation necessary at the head of the reservoir sixty thousand dollars: *Provided*, That the whole cost of the work shall not exceed the sum of one hundred and fifty thousand dollars, to be done by contract or otherwise as the Secretary of War may determine: *Provided further*, That notwithstanding the limitation prescribed by the acts of Congress approved July fifteenth, eighteen hundred and eighty-two, and February twenty-sixth, eighteen hundred and eighty-five, the Secretary of War be, and he is hereby, authorized to pay to Receiving reservoir. Improving, protecting, etc. *Provisos.* Cost. Payment to Thomas Ready for condemned land. Vol. 22, p. 168. Vol. 23, p. 332.

Thomas Ready the sum of four hundred and seventy dollars and ninety cents out of the unexpended balance of the appropriation of fifty-one thousand three hundred and seventy dollars to pay for land to extend aqueduct, made by the act entitled "An act to increase the water supply of the city of Washington, and for other purposes," approved July fifteenth, eighteen hundred and eighty-two, which sum shall be in full for the appraised value of land owned by the said Thomas Ready and taken by the United States for the requirements and purposes of that act: *Provided*, That no payment hereunder shall be made until the Attorney-General shall have decided that an absolute title to the premises shall vest in the United States.

Vol. 22, p. 168.

No payment without absolute title.

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Approved, March 3, 1893.

March 3, 1893. Vol. 27, p. 555.

CHAP. 201.—An act to authorize the construction of a bridge over the Tennessee River at or near Sheffield, Alabama.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Tennessee Bridge and Ferry Company, of Alabama, a corporation duly and legally incorporated under the laws of the State of Alabama, its successors or assigns, to construct and maintain a bridge over the Tennessee River at or near Sheffield, in Colbert County, Alabama. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

Tennessee Bridge and Ferry Company may bridge Tennessee River at Sheffield, Ala.

Railway, etc., bridge.

Tolls.

SEC. 2. That any bridge built under the provisions of this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over the said bridge, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post roads in the United States; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes, and all telegraph and telephone companies shall have equal rights and privileges in constructing and maintaining their lines across said bridge.

Lawful structure and post route.

Postal telegraph.

Telegraph, etc., companies.

SEC. 3. That said bridge shall be constructed as a draw-bridge of such character of construction, and having such width of draw-openings and such elevation above high water as the Secretary of War may prescribe: and the draw-openings of said bridge shall be so protected and arranged that water crafts can be worked through them at

Construction.

Drawbridge.

Draw-openings.

any and all times; and the piers of said bridge shall be parallel with and the bridge itself at right angles to the current of the river: *Provided*, That said draw shall be opened promptly upon reasonable signals for the passage of boats; and said company or corporation shall maintain, at its own expense, from sunset until sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe. No bridge shall be erected or maintained under authority of this act which at any time substantially or materially obstructs the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the cause may be brought in the circuit court of the United States or the State of Alabama in whose jurisdiction any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers or exempt this bridge from the operation of the same.

Piers.

Provisos.
Opening draw.

Lights, etc.

Unobstructed navigation.

Litigation.

Existing laws not affected.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

Use by other railroad companies.

Terms.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War for his examination and approval a design and drawing of the bridge, and a map of location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the directions and strength of currents at all stages, and soundings accurately showing the bed of the stream, and the location of any other bridge or bridges and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built, and if any change is required by the

Secretary of War to approve plans, etc.

Changes.

Secretary of War in the plan of said bridge while the same is in progress of construction, or after its completion, or if the entire removal of said bridge is required by him at any time, the cost of such change or removal shall be paid by the company owning or controlling said bridge.

Amendments, etc.

SEC. 6. That the right to alter or amend or repeal this act is hereby expressly reserved.

Commencement and completion.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Approved, March 3, 1893.

March 3, 1893. Vol. 27, p. 572.

CHAP. 208.—An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, and for other purposes.

Sundry civil expenses appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, namely:

* * * * * * *

Under War Department.

UNDER THE WAR DEPARTMENT.

* * * * * * *

Buildings and grounds, D. C.

BUILDINGS AND GROUNDS IN AND AROUND WASHINGTON.

Improvement and care.

For the improvement and care of public grounds as follows:

For improvement of grounds north and south of the Executive Mansion, four thousand dollars;

For ordinary care of greenhouses and nursery, two thousand dollars.

For ordinary care of Lafayette Square, one thousand dollars.

For ordinary care of Franklin Square, one thousand dollars.

For care and improvement of Monument grounds, two thousand dollars.

For continuing improvement of reservation numbered seventeen and site of old canal northwest of same, three thousand dollars: *Provided*, That no part thereof shall be expended upon other than property belonging to the United States.

Proviso. Condition.

For construction and repair of post-and-chain fences, and constructing stone coping around reservations, one thousand dollars.

For manure, and hauling the same, five thousand dollars.

For painting watchmen's lodges, iron fences, vases, lamps, and lamp-posts, five hundred dollars.

For purchase and repair of seats, one thousand dollars.

For purchase and repair of tools, two thousand dollars.

For trees, tree and plant stakes, labels, lime, whitewashing and stock for nursery, two thousand dollars.

For removing snow and ice, one thousand two hundred dollars.

For flowerpots, twine, baskets, wire, splints, moss, and lycopodium, one thousand dollars.

For care, construction, and repair of fountains, one thousand five hundred dollars.

For abating nuisances, five hundred dollars.

For improvement, care and maintinance of various reservations, ten thousand dollars.

For improvement, maintenance, and care of Smithsonian Grounds, including construction of asphalt roads and paths, two thousand five hundred dollars.

For improvement, care, and maintenance of Judiciary Square, three thousand dollars.

Limit for concrete pavements.

That under appropriations herein contained no contract shall be made for making or repairing concrete or asphalt pavements in Washington City at a higher price than two dollars and twenty-five cents per square yard for a quality equal to the best laid in the District of Columbia prior to July first, eighteen hundred and eighty-six, and with a base of not less than six inches in thickness.

Executive Mansion.

For repairs and fuel at the Executive Mansion, as follows:

Repairs, fuel, etc.

For care, repair, and refurnishing the Executive Mansion, eighteen thousand dollars, to be expended by contract or otherwise, as the President may determine.

For fuel for the Executive Mansion, greenhouses, and stable, three thousand dollars.

For care and necessary repair of greenhouses, four thousand dollars.

For renewing the superstructures of one greenhouse connected with the Executive Mansion, one thousand dollars.

For repairs to conservatory, Executive Mansion, one thousand dollars.

Lighting Executive Mansion and public grounds.

LIGHTING THE EXECUTIVE MANSION AND PUBLIC GROUNDS: For gas, pay of lamp-lighters, gas fitters, and laborers; purchase, erection, and repair of lamps and lamp-posts; purchase of matches, and for repairs of all kinds; fuel and lights for office, office stables, watchmen's lodges, and for the greenhouses at the nursery, fourteen thousand dollars: *Provided*, That for each six-foot burner not connected with a meter in the lamps on the public grounds no more than twenty-one dollars and fifty cents shall be paid per lamp for gas, including lighting, cleaning, and keeping in repair the lamps, under any expenditure provided for in this act; and said lamps shall burn not less than three thousand hours per annum; and authority is hereby given to substitute other illuminating material for the same or less price, and to use so much of the sum hereby appropriated as may be necessary for that purpose: *Provided*, That before any expenditures are made from the appropriations herein provided for, the contracting gas company shall equip each lamp with a self-regulating burner and

Provisos.

Maximum per lamp.

Burners.

Secretary of War in the plan of said bridge while the same is in progress of construction, or after its completion, or if the entire removal of said bridge is required by him at any time, the cost of such change or removal shall be paid by the company owning or controlling said bridge.

Amendments, etc.

SEC. 6. That the right to alter or amend or repeal this act is hereby expressly reserved.

Commencement and completion.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date hereof.

Approved, March 3, 1893.

March 3, 1893. Vol. 27, p. 572.

CHAP. 208.—An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, and for other purposes.

Sundry civil expenses appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, namely:

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Under War Department.

UNDER THE WAR DEPARTMENT.

* * * * * * *

Buildings and grounds, D. C.

BUILDINGS AND GROUNDS IN AND AROUND WASHINGTON.

Improvement and care.

For the improvement and care of public grounds as follows:

For improvement of grounds north and south of the Executive Mansion, four thousand dollars;

For ordinary care of greenhouses and nursery, two thousand dollars.

For ordinary care of Lafayette Square, one thousand dollars.

For ordinary care of Franklin Square, one thousand dollars.

For care and improvement of Monument grounds, two thousand dollars.

For continuing improvement of reservation numbered seventeen and site of old canal northwest of same, three thousand dollars: *Provided*, That no part thereof shall be expended upon other than property belonging to the United States.

Proviso. Condition.

For construction and repair of post-and-chain fences, and constructing stone coping around reservations, one thousand dollars.

For manure, and hauling the same, five thousand dollars.

For painting watchmen's lodges, iron fences, vases, lamps, and lamp-posts, five hundred dollars.

For purchase and repair of seats, one thousand dollars.

For purchase and repair of tools, two thousand dollars.

For trees, tree and plant stakes, labels, lime, whitewashing and stock for nursery, two thousand dollars.

For removing snow and ice, one thousand two hundred dollars.

For flowerpots, twine, baskets, wire, splints, moss, and lycopodium, one thousand dollars.

For care, construction, and repair of fountains, one thousand five hundred dollars.

For abating nuisances, five hundred dollars.

For improvement, care and maintinance of various reservations, ten thousand dollars.

For improvement, maintenance, and care of Smithsonian Grounds, including construction of asphalt roads and paths, two thousand five hundred dollars.

For improvement, care, and maintenance of Judiciary Square, three thousand dollars.

Limit for concrete pavements.

That under appropriations herein contained no contract shall be made for making or repairing concrete or asphalt pavements in Washington City at a higher price than two dollars and twenty-five cents per square yard for a quality equal to the best laid in the District of Columbia prior to July first, eighteen hundred and eighty-six, and with a base of not less than six inches in thickness.

Executive Mansion.

For repairs and fuel at the Executive Mansion, as follows:

Repairs, fuel, etc.

For care, repair, and refurnishing the Executive Mansion, eighteen thousand dollars, to be expended by contract or otherwise, as the President may determine.

For fuel for the Executive Mansion, greenhouses, and stable, three thousand dollars.

For care and necessary repair of greenhouses, four thousand dollars.

For renewing the superstructures of one greenhouse connected with the Executive Mansion, one thousand dollars.

For repairs to conservatory, Executive Mansion, one thousand dollars.

Lighting Executive Mansion and public grounds.

LIGHTING THE EXECUTIVE MANSION AND PUBLIC GROUNDS: For gas, pay of lamp-lighters, gas fitters, and laborers; purchase, erection, and repair of lamps and lamp-posts; purchase of matches, and for repairs of all kinds; fuel and lights for office, office stables, watchmen's lodges, and for the greenhouses at the nursery, fourteen thousand dollars: *Provided*, That for each six-foot burner not connected with a meter in the lamps on the public grounds no more than twenty-one dollars and fifty cents shall be paid per lamp for gas, including lighting, cleaning, and keeping in repair the lamps, under any expenditure provided for in this act; and said lamps shall burn not less than three thousand hours per annum; and authority is hereby given to substitute other illuminating material for the same or less price, and to use so much of the sum hereby appropriated as may be necessary for that purpose: *Provided*, That before any expenditures are made from the appropriations herein provided for, the contracting gas company shall equip each lamp with a self-regulating burner and

Provisos.

Maximum per lamp.

Burners.

tip, so combined and adjusted as to secure u
nary variations of pressure and density a co
six cubic feet of gas per hour.

Electric lights. For electric lights for three hundred and six
from seven posts, at forty cents per light p
thousand and twenty-two dollars.

Repair of water pipes, etc. REPAIR OF WATER PIPES: For repairing a
water pipes, purchase of apparatus for cleani
chase of hose, and cleaning the springs and
renewing the pipes of the same that supply
the Executive Mansion, and the building
War, and Navy Departments, two thousand
dollars.

Telegraph, Capitol, Departments, and Government Printing Office. TELEGRAPH TO CONNECT THE CAPITOL
DEPARTMENTS AND GOVERNMENT PRINTI
For care and repair of existing lines, one
hundred and fifty dollars.

Washington Monument. WASHINGTON MONUMENT: For the care
Care and maintenance. nance of the Washington Monument, namely:
todian, at one hundred dollars per month;
gineer, at eighty dollars per month; one as
engineer, at sixty dollars per month; one fir
dollars per month; one assistant fireman, at
lars per month; one conductor of elevator ca
five dollars per month; one attendant on floo
lars per month; one attendant on top floor, at
per month; three night and day watchmen, a
per month each; in all, eight thousand five
twenty dollars.

Expenses. For fuel, lights, oil, waste, packing, tools, ma
brushes, brooms, lanterns, rope, nails, screw
tric lights, heating apparatus, oil stoves for
and upper and lower floor, repairs to engine
namos, elevator, and repairs of all kinds co
the monument and machinery, and purchase
sary articles for keeping the monument, mac
tor, and electric-light plant in good order, th
dollars.

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Yellowstone National Park. IMPROVEMENT OF THE YELLOWSTONE
PARK: For the improvement of the Yellowst
Park, thirty thousand dollars, to be expended
the direction of the Secretary of War.

* * * * *

Miscellaneous objects. MISCELLANEOUS OBJECTS.

Survey, northern and northwestern lakes. SURVEY OF NORTHERN AND NORTHWEST
For printing and issuing charts for use of n
electrotyping plates for chart printing, two t
lars.

For surveys, additions to, and correcting eng
twenty-five thousand dollars.

Transporting maps, etc. TRANSPORTATION OF REPORTS AND MAPS
COUNTRIES: For the transportation of repo

to foreign countries through the Smithsonian Institution, one hundred dollars.

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HARBOR OF NEW YORK: For prevention of obstructive and injurious deposits within the harbor and adjacent waters of New York City: Harbor of New York.

For pay of inspectors and deputy inspectors, office force, and expenses of office, fifteen thousand dollars; Inspectors, etc.

For pay of crew and maintenance of steamer Argus, eight thousand dollars; Maintenance of steamers.

For pay of crew and maintenance of steamer Nimrod, eight thousand dollars;

In all, thirty-one thousand dollars.

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ENGINEER DEPARTMENT.

Engineer Department.

River and harbor improvements.

For continuing improvement of harbor at Philadelphia, Pennsylvania: Continuing improvement removal of Smiths Island and Windmill Island, Pennsylvania, and Pettys Island, New Jersey, and adjacent shoals, five hundred thousand dollars. Philadelphia, Pa. Removal of islands.

For improving harbor at Galveston, Texas: Continuing improvement to entrance to harbor, one million dollars. Galveston Harbor.

For improving Hay Lake Channel, Saint Marys River, Michigan: Continuing improvement, two hundred and twenty-five thousand dollars. Hay Lake Channel, St. Marys River, Mich.

For improving Hudson River, New York: Continuing improvement, five hundred thousand dollars. Hudson River, N. Y.

That the Secretary of War be, and he is hereby, authorized to expend, under the supervision of the Chief of Engineers, so much of the unexpended balance remaining from the appropriation of July thirteenth, eighteen hundred and ninety-two, for improving harbor at Oswego, New York, and now available, as may be necessary and he may approve to remove a rocky ledge and other substances, and to deepen said harbor within the lines thereof to a uniform depth. Oswego, N. Y. Unexpended balance may be expended. Laws, 1st sess. 52d Cong., p. 90.

For improving Great Kanawha River, West Virginia: Continuing improvement, five hundred thousand dollars. Great Kanawha River, W. Va.

For improving Saint Johns River, Florida: Continuing improvement of channel over bar at the mouth, two hundred and eighty-four thousand five hundred dollars. Saint Johns River, Fla.

For improving Mississippi River from the mouth of the Ohio River to the landing on the west bank below the Washington avenue bridge, Minneapolis, Minnesota: Continuing improvement from the mouth of the Ohio River to the mouth of the Missouri River, six hundred and fifty-eight thousand three hundred and thirty-three dollars and thirty-three cents; continuing improvement from the mouth of the Missouri River to Minneapolis, eight hundred and sixty-six thousand six hundred and sixty-six dollars and sixty-seven cents; in all, one million five hundred and twenty-five thousand dollars. Mississippi River, from mouth of Ohio River to landing, Minneapolis, Minn.

For improving Saint Marys River at the Falls, Michigan: Continuing improvement, one million two hundred and Saint Marys River at Falls, Mich.

Proviso. thirty thousand dollars: *Provided*, That of the amount hereby appropriated the sum of twenty-five thousand dollars, or so much thereof as may be necessary, may be expended in widening the present channel at "the elbow" at the lower end of Lake George, in Saint Mary's River, Michigan.

Channel at "elbow" of Lake George.

Channel, Chicago, Duluth, to Buffalo. For improving channel connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, eight hundred and seventy-five thousand dollars.

Cascades of Columbia River, Oregon. For improving canal at the Cascades of the Columbia River, Oregon: Continuing improvement, one million two hundred and thirty-nine thousand six hundred and fifty-three dollars.

Harbor of refuge, Point Judith, R. I. For harbor of refuge at Point Judith, Rhode Island: Continuing improvement, one hundred thousand dollars.

Charleston, S.C. Sullivan Island and Mount Pleasant Shore. For improving harbor at Charleston, South Carolina, including Sullivan Island and Mount Pleasant Shore: Continuing improvement, seven hundred and fifty thousand dollars.

Savannah, Ga. For improving harbor at Savannah, Georgia: Continuing improvement, one million dollars.

Mobile, Ala. For improving harbor at Mobile, Alabama: Continuing improvement, five hundred thousand dollars.

Humboldt, Cal. For improving harbor and bay at Humboldt, California: Continuing improvement, five hundred and twenty-two thousand dollars.

Mississippi River Commission. Head of the passes to mouth of Ohio. Salaries, etc. Under Mississippi River Commission: For improving Mississippi River from head of the passes to the mouth of the Ohio River, including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission, two million six hundred and sixty-five thousand dollars.

Missouri River Commission. Salaries, etc. Under Missouri River Commission: For improving Missouri River from its mouth to Sioux City, Iowa, including salaries, clerical, office, traveling, and miscellaneous expenses of the Missouri River Commission, surveys, permanent bench marks and gauges, seven hundred and fifty thousand dollars, fifty thousand dollars of which may be used for removal of snags and other like obstructions in the Missouri River above Sioux City, Iowa; to be expended under the direction of the Secretary of War: *Provided*, *Proviso.* Limit of expenditures. That not more than three-fourths of the foregoing appropriations under head of "Engineer Department," for rivers and harbors, shall be expended during the fiscal year ending June thirtieth, eighteen hundred and ninety-four; but Exceptions. this proviso shall not apply to the appropriations herein made for the improvements of the Mississippi and Missouri Rivers and of Hay Lake Channel.

Secretary of War to furnish annual estimates on or before October 1. And hereafter the Secretary of War shall furnish to the Secretary of the Treasury, on or before the first day of October of each year, estimates of all appropriations required for river and harbor improvements for the next fiscal year to be included in the Book of Estimates prepared by law under his direction.

Cincinnati, Ohio. Survey for ice harbor. And the Secretary of War is hereby instructed to cause a preliminary examination and survey to be made at the mouth of the Crawfish Creek, in the first ward, and the

mouth of Mill Creek, in the twenty-first ward of the city of Cincinnati, Ohio, as to availability of either or both said locations for an ice harbor.

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UNDER LEGISLATIVE. Legislative.

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BUILDING FOR THE LIBRARY OF CONGRESS. Library of Congress.

For continuing the construction of the building for the Library of Congress, and for each and every purpose connected with the same, nine hundred and fifty thousand dollars: *Provided*, That the officer disbursing appropriations for the construction of the Congressional Library building shall receive as compensation for such services one-quarter of one per centum on the amount of all disbursements made and to be made by him for such building. Continuing construction. *Proviso.* Compensation of disbursing officer.

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PUBLIC PRINTING AND BINDING. Public printing and binding.

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The heads of the Executive Departments, before transmitting their annual reports to Congress, the printing of which is chargeable to this appropriation, shall cause the same to be carefully examined, and shall exclude therefrom all matter, including engravings, maps, drawings, and illustrations, except such as they shall certify in their letters transmitting such reports to be necessary and to relate entirely to the transaction of public business.

* * * * * * *

No report, document, or publication of any kind distributed by, or from an Executive Department or bureau of the Government shall hereafter contain any notice that same is sent with "the compliments" of an officer of the Government or with any special notice that it is so sent. Documents not to contain "the compliments" of any officer.

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Approved, March 3, 1893.

CHAP. 210.—An act making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, eighteen hundred and ninety-three, and for prior years, and for other purposes. March 3, 1893. Vol. 27, p. 646.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year, eighteen hundred and ninety-three, and for prior years, and for other objects hereinafter stated, namely: Deficiencies appropriations.

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War Department.

WAR DEPARTMENT.

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Miscellaneous.

MISCELLANEOUS.

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Care, etc., public grounds, D. C.

IMPROVEMENT AND CARE OF PUBLIC GROUNDS, DISTRICT OF COLUMBIA: For removal of snow and ice, five hundred dollars.

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Green River, Ky., rebuilding lock.

REBUILDING LOCK ON GREEN RIVER, KENTUCKY: For rebuilding lock numbered two on Green River, at Rumsey, in the State of Kentucky, sixty-five thousand dollars, or so much thereof as may be necessary.

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JUDGMENTS, COURT OF CLAIMS.

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Fox and Wisconsin rivers improvement.

Payment of flowage damages.

Vol. 18, p. 506.

FOX AND WISCONSIN RIVER IMPROVEMENT: For payment of the judgments and awards rendered against the United States for flowage damages caused by the improvement of the Fox and Wisconsin rivers, in the State of Wisconsin, under the act approved March third, eighteen hundred and seventy-five, as reported to Congress by the Attorney-General, and fully set forth in Senate Executive Document Numbered Ninety, second session of the Fifty-second Congress, including commissioners' accounts as therein set forth, thirty thousand nine hundred and eighty-five dollars and fifty cents.

G. C. Griffith judgment.

Laws, 1st sess. 52d Cong., p. 309.

The appropriation of one hundred and nine thousand and twenty-two dollars and thirty-three cents made by the act of July twenty-eighth, eighteen hundred and ninety-two, for payment of the judgments and awards rendered against the United States for flowage damages caused by the improvement of the Fox and Wisconsin rivers, in the State of Wisconsin, is hereby made applicable to the payment of the judgment of G. C. Griffith in the sum of one thousand one hundred and seventy-nine dollars, the same having been inadvertently omitted in the report of the Attorney-General of such judgments, but included in the total sum appropriated.

Appropriation made applicable.

Claims certified by accounting officers.

Vol. 18, p. 110.

Vol. 23, p. 254.

SEC. 2. That for the payment of the following claims certified to be due by the several accounting officers of the Treasury Department under appropriations the balances of which have been exhausted or carried to the surplus fund under the provisions of section five of the act of June twentieth, eighteen hundred and seventy-four, and under appropriations heretofore treated as permanent, being for the service of the fiscal year eighteen hundred and ninety, and prior years, unless otherwise stated, and which have been certified to Congress under section two of the act of July seventh, eighteen hundred and eighty-four, as fully

rth in House Executive Document Numbered One
ed and ninety-one, Fifty-second Congress, second
n, there is appropriated as follows:

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MS ALLOWED BY THE THIRD AUDITOR AND SECOND COMPTROLLER. Claims allowed by Third Auditor and Second Comptroller.

WAR DEPARTMENT. War Department.

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contingencies of fortifications, forty five dollars and wo cents. Fortifications.

improving harbor at San Francisco, California, exor service over Pacific railroads, thirty five cents. San Francisco Harbor, Cal.

improving Little River, Missouri and Arkansas, cents, Little River, Mo. and Ark.

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. 3. That for the payment of the following claims certo be due by the several accounting officers of the ıry Department under appropriations the balances of have been exhausted or carried to the surplus fund the provisions of section five of the act of June ieth, eighteen hundred and seventy-four, and under priations heretofore treated as permanent, being for rvice of the fiscal year eighteen hundred and ninety, rior years, unless otherwise stated, and which have ertified to Congress under section two of the act of seventh, eighteen hundred and eighty-four, as fully th in Senate Executive Document Numbered Ninety-Fifty-second Congress, second session, there is apated as follows: Claims certified by accounting officers. Vol. 18, p. 110. Vol. 23, p. 254.

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MS ALLOWED BY THE THIRD AUDITOR AND SECOND COMPTROLLER. Claims allowed by Third Auditor and Second Comptroller.

WAR DEPARTMENT. War Department.

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contingencies of fortifications, thirty-one dollars and ents. Fortifications.

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roved, March 3, 1893.

P. 211.—An act making appropriations for the legislative, ve, and judicial expenses of the Government for the fiscal year June thirtieth, eighteen hundred and ninety-four, and for other es. March 3, 1893. Vol. 27, p. 675.

t enacted by the Senate and House of Representatives United States of America in Congress assembled, That llowing sums be, and the same are hereby, appro- d, out of any money in the Treasury not otherwise priated, in full compensation for the service of the Legislative, executive, and judicial expenses appropriations.

fiscal year ending June thirtieth, eighteen hundred and ninety-four, for the objects hereinafter expressed, namely:

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War Department.

WAR DEPARTMENT.

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Engineer office.

IN THE OFFICE OF THE CHIEF OF ENGINEERS: Chief clerk, at two thousand dollars; four clerks of class four; two clerks of class three; three clerks of class two; three clerks of class one; one clerk, at one thousand dollars; one assistant messenger; and two laborers; in all, twenty-three thousand two hundred and forty dollars.

Draftsmen, etc.

And the services of skilled draftsmen, civil engineers, and such other services as the Secretary of War may deem necessary, may be employed only in the office of the Chief of Engineers to carry into effect the various appropriations for rivers and harbors, fortifications, and surveys to be paid from such appropriations: *Provided*, That the expenditures on this account for the fiscal year ending June thirtieth, eighteen hundred and ninety-four, shall not exceed sixty thousand dollars; and that the Secretary of War shall each year, in the annual estimates, report to Congress the number of persons so employed and the amount paid to each.

Proviso.

Limit.

Report.

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Public buildings and grounds

PUBLIC BUILDINGS AND GROUNDS.

Clerk, messenger, gardener.

OFFICE OF PUBLIC BUILDINGS AND GROUNDS: For one clerk, one thousand six hundred dollars; one messenger; one public gardener, one thousand eight hundred dollars; in all, four thousand two hundred and forty dollars.

Overseers, etc.

For overseers, draftsman, foremen, mechanics, gardeners, and laborers employed in the public grounds, twenty-eight thousand dollars.

Watchmen.

For day watchman in Franklin Square, six hundred and sixty dollars.

For day watchman in Lafayette Square, six hundred and sixty dollars.

For two day watchmen in Smithsonian Grounds, at six hundred and sixty dollars each, one thousand three hundred and twenty dollars.

For two night watchmen in Smithsonian Grounds, at seven hundred and twenty dollars each, one thousand four hundred and forty dollars.

For one day watchman at Judiciary Square and one at Lincoln Square and adjacent reservations, at six hundred and sixty dollars each, one thousand three hundred and twenty dollars.

For one night watchman in Judiciary Square, seven hundred and twenty dollars.

For one day watchman at Iowa Circle, one at Thomas Circle and neighboring reservations; one at Rawlins Square and Washington Circle; one at Dupont Circle and neighboring reservations; one at McPherson and Farragut

quares; one at Stanton Square and neighboring reservations; two at Henry Square and Seaton Square and reserations east of Botanic Garden; one at Mount Vernon quare and adjacent reservations; one for the greenhouses nd nursery; one at grounds south of Executive Mansion; leven in all, at six hundred and sixty dollars each, seven housand two hundred and sixty dollars.

For one night watchman at Henry Square (Armory) and eaton Squares and reservations east of Botanic Garden, even hundred and twenty dollars.

For one night watchman at Garfield Park, seven hunlred and twenty dollars.

For contingent and incidental expenses, five hundred lollars. Contingent expenses.

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Approved, March 3, 1893.

CHAP. 218.—An act to authorize the Lake Shore and Michigan uthern Railroad Company to renew its railroad bridge across the lumet River upon or near the site of its present bridge and upon a ation and plans to be approved by the Secretary of War, and to rate the same. March 3, 1893. Vol. 27, p. 744.

Be it enacted by the Senate and House of Representatives the United States of America in Congress assembled, That e Lake Shore and Michigan Southern Railroad Com- ny, a corporation existing under the laws of the States of inois and Indiana, and now operating a railroad therein, , and it is hereby, authorized to renew its railroad bridge ross the Calumet River upon or near the site of its pres- t bridge, upon such location and plans as may be ap- oved by the Secretary of War, and to operate the same. Lake Shore and Michigan Southern Railroad Company may renew bridge across Calumet River. Location. Secretary of War to approve plans, etc.

SEC. 2. That said bridge shall be so kept and managed at times as to afford proper means and ways for the passage vessels, barges, or rafts, both by day and by night, and e draw of said bridge shall be opened promptly upon rea- nable signals for the passage of boats, vessels, or other ter craft, and in no case shall unnecessary delay occur opening said draw; and there shall be displayed on said idge from sunset to sunrise, by the owners thereof, such hts or other signals as the Light-House Board may pre- ribe. And any changes in the structure of said bridge hich the Secretary of War may hereafter require in the terest of navigation shall be made by the owners thereof t their own proper cost and expense. Opening of draw, etc. Lights, etc. Structural changes. Cost.

SEC. 3. That the right to alter or repeal this act is hereby xpressly reserved. Amendment.

Approved, March 3, 1893.

RESOLUTIONS.

January 26, 1893. Vol. 27, p. 754.

[No. 9.] Joint resolution to authorize the Secretary of War to grant permits for the use of reservations and public spaces in the city of Washington, and for other purposes.

Inauguration day. Permits to use reservations, etc., in Washington authorized.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized to grant permits to the Executive Committee on Inaugural Ceremonies for the use of any reservations, or other public spaces, in the city of Washington, on occasion of the inauguration of the President-elect on the fourth day of March, eighteen hundred and ninety-three, which in his opinion will inflict no serious or permanent injury upon such reservations or public spaces; and the Commissioners of the District of Columbia may designate for such and other purposes such streets, avenues, and sidewalks in the District as they may deem proper and necessary therefor.

Approved, January 26, 1893.

February 3, 1893. Vol. 27, p. 754.

[No. 10.] Joint resolution directing the Secretary of War to investigate the subject of raft-towing on the Great Lakes and their connecting waters.

Great Lakes. Commission to investigate, etc., raft-towing.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he is hereby, directed to appoint a board, to consist of three officers of the Engineer Corps of the Army, to investigate the subject of raft-towing on the Great Lakes and their connecting waters, and to report to Congress as to what restrictions, if any, should be placed upon the size and manner of constructing and towing rafts upon said Great Lakes and their connecting waters.

Approved, February 3, 1893.

February 25, 1893. Vol. 27, p. 756.

[No. 16.] Joint resolution to provide for the construction of a wharf as a means of approach to the monument to be erected at Wakefield, Virginia, to mark the birthplace of George Washington.

Birthplace of George Washington. Appropriation for wharf at Wakefield. Vol. 21, p. 519.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the sum of eleven thousand one hundred and thirty-six dollars, or so much thereof as may be necessary, of the amount appropriated by an act of Congress approved February twenty-sixth, eighteen hundred and eighty-one, for the purpose of erecting a monument at and marking the birthplace of George Washington, may be expended and used, under the direction of the Secretary of State, to construct a wharf as a means of approach to the said proposed monument at Wakefield, Virginia; the said wharf to be constructed of cast-iron screw piles, with a timber deck, as planned and estimated for by Colonel Thomas L. Casey, of the Engineer

s, United States Army, in his letter of April eigh-
h, eighteen hundred and eighty-four, to the honorable
erick T. Frelinghuysen, Secretary of State.
proved, February 25, 1893.

PRIVATE ACTS.

AP. 60.—An act for the relief of Clement Reeves.

February 3, 1893.
Vol. 27, p. 814.

*it enacted by the Senate and House of Representatives
United States of America in Congress assembled*, That
ecretary of the Treasury is hereby directed to pay to
ent Reeves, out of any moneys in the Treasury not
wise appropriated, the sum of six hundred and twenty-
dollars and eighty-five cents, in payment for earth
ited by him on the battery near Delaware City, Dela-
, in eighteen hundred and seventy-six.

Clement Reeves.
Payment to.

proved, February 3, 1893.

**AP. 80.—An act to refer the claim of Jessie Benton Fremont to
n lands, and the improvement thereon, in San Francisco, Cali-
, to the Court of Claims.**

February 10, 1893.
Vol. 27, p. 816.

*it enacted by the Senate and House of Representatives
United States of America in Congress assembled*, That
laim of Jessie Benton Fremont to certain lands, and
mprovements thereon, at Port San Jose, in San Fran-
, State of California, and her claim for compensation
ie taking, use, and occupation thereof, be referred to
Court of Claims to hear and determine the same to
nent, notwithstanding the lapse of time, with right of
al as in other cases. The said Jessie Benton Fremont,
eirs, assigns, or legal representatives, shall commence
action in said Court of Claims by petition, filed within
months from the passage of this act, and the said court
reby directed to ascertain concerning the ownership
im in law or equity of the said Jessie Benton Fre-
, her heirs, assigns, or legal representatives, to the
land; also the facts constituting the ownership or
in law of the United States thereto. Said court
also ascertain and determine the value of said lands
e time they were taken by the United States for mili-
purposes and the value of all improvements thereon.
all also ascertain and determine the present value of
lands and what would be fair compensation for the
nd occupation thereof from the time they were taken
ie Government to the date of the finding by the court
eport its judgment as to the sum that should be paid
Jessie Benton Fremont in full payment for the taking
se of said land by the United States.

Jessie Benton Fremont.
Claim referred to Court of Claims.

proved, February 10, 1893.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

GUN AND MORTAR BATTERIES—TORPEDO SHED, NEW YORK HARBOR.

REPORT OF LIEUT. COL. GEORGE L. GILLESPIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

IMPROVEMENTS.

a. Mortar battery.
b. Gun-lift battery.
c. Torpedo shed.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., July 8, 1893.

GENERAL: I have the honor to transmit herewith annual reports, in duplicate, for the fiscal year ending June 30, 1893, upon fortifications in my charge.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

GUN AND MORTAR BATTERIES.

Plans have been prepared for the new works of defense, and during the fiscal year operations were carried on upon the construction of Mortar Battery No. 1, with ditch defense, arranged for sixteen 12-inch breech-loading rifled mortars, and upon one 12-inch gun battery, with hydraulic lifts for two 12-inch, breech-loading, high-power steel rifles, of which mention was made in the last annual report.

1 A.

MORTAR BATTERY No. 1.

The mortar battery was begun in November, 1890, under instructions from the Chief of Engineers dated August 6 and September 13, 1890, in accordance with plans of The Board of Engineers dated September 28, 1888.

From the appropriation made by act of Congress approved August 18, 1890, for gun and mortar batteries, an allotment of $201,000 was made for its construction, and on February 24, 1893, a further allotment of $33,000 was made from the appropriation for gun and mortar batteries, act of July 23, 1892, to be applied to the completion of this mortar battery.

On March 10, 1893, an allotment of $20,000 was made from the appropriation, act of February 18, 1893, for "gun and mortar batteries, for the construction of gun and mortar platforms," "to be applied to the construction of eight mortar platforms." At the close of the last fiscal year the condition of the work was as follows:

The concrete masonry of the battery was completed, excepting the floors of the magazines and passages, the sloping concrete surface capping of the retaining-walls of the mortar pits and designed to protect the slopes from the effects of blast, the counterscarp wall, and galleries. The line of the ditch had been cleared of undergrowth and stumps and graded ready for the foundations of the counterscarp wall, and 13,0[illegible] cubic yards of concrete had been put in place.

At the close of the last fiscal year two contracts were in force:

1. With the Lawrence Cement Company, dated December 29, 18[illegible] (expired January 1, 1892, extended to August 1, 1892), approved by the Chief of Engineers January 12, 1891, for the delivery of 30,0[illegible] barrels of cement, at $1.02 per barrel. Completed July 25, 1892.

2. With John A. Bouker, dated December 29, 1890 (expired January 1, 1892, extended to November 1, 1892), approved by the Chief of Engineers January 8, 1881, for the delivery of 21,000 cubic yards of broken granite, at $1.63 per cubic yard. Completed July 29, 1892.

Under sealed proposals opened July 20, 1892, a contract was made July 22, 1892, with Calvin Tomkins, of New York, the lowest responsible bidder, for the delivery of 25,000 barrels "Old Newark" Rosendale cement, at $0.939 per barrel, and 20,000 cubic yards of broken stone at $1.28¾ per cubic yard.

There have been delivered under this agreement, up to June 30, 18[illegible], 12,102 cubic yards of broken stone and 23,410 barrels of cement, which amounts 10,000 cubic yards of broken stone and 19,773 barrels of cement were applied to the construction of masonry at the mortar battery.

Under sealed proposals opened April 12, 1893, bids for furnishing certain material for the construction of mortar platforms were accepted as follows:

WALDO & STOUT, BRIDGEPORT, CONN.

192 aluminium bronze bolts, at 29½ cents per pound.
192 phosphor-bronze washers, at 22½ cents per pound.
192 steel nuts (for above bolts), at 57½ cents each.
128 wrought-iron anchor bolts, with hexagonal nuts, at 39 cents each.

The aggregate cost of the above bolts and nuts for eight platforms is $3,742.80.

CASEY & SHERWOOD, NEW YORK CITY.

For eight sets of eight stones each, or 1,063 cubic feet granite rings (which form the upper surface of the mortar platforms and the seat of the base ring of the mortar carriage), at $319 for one set, equivalent to $2.4007 per cubic foot.

All of the above material is to be delivered on or before July 15, 1893.

The construction of masonry was continued throughout the year, excepting from December 1, 1892, to May 1, 1893, during which time it was necessarily suspended on account of cold weather.

The counterscarp wall (2,200 feet in length) and galleries are completed, excepting about 140 feet of the wall where openings have been left for construction purposes. The floors in the magazines and main galleries are laid within 4 inches of their finished level and the concrete protection for the slopes in the mortar pits is nearly finished.

The total masonry constructed during the year was 13,827 cubic yards and from the beginning 26,852 cubic yards. The average cost per cubic yard for all was $5.20.

The work of filling sand in the embankments covering the magazines and passage ways and surrounding the mortar pits has been carried on continuously since September 12, 1892, and at the close of the fiscal year 118,478 cubic yards had been excavated, hauled, and deposited, completing the sand cover inside the ditch, excepting about 5,000 cubic yards. This, with 9,449 cubic yards reported last year, makes a total of 127,927 cubic yards to June 30, 1893.

The progress sheet forwarded herewith (Pl. 1*) shows the total masonry constructed to June 30, 1893; also, in detail, that for each month of the fiscal year. The same drawing shows the embankment to date.

The total estimated amount of sand filling inside the ditch is 125,184 cubic yards; the amount in place June 30, 1893, was 127,927 cubic yards, an excess over the quantity estimated of 2,743 cubic yards. This excess is not due to an error in the estimate, and is easily accounted for. The sand at the battery site is dry and shifting; high winds frequently prevail, during which sand deposited on the higher portions of the embankments is blown away and again deposited in the ditch and upon those slopes not exposed to the wind. This will be checked when the sod which is to cover the upper and more exposed parts of the slopes is in place, and the surplus sand can all be utilized economically in filling in the covering of sand exterior to and resting against the counterscarp wall. Experiments made during the year indicate that the long slopes adjoining the ditch can be successfully and economic-

* Omitted.

ally protected from wind and weather by planting thereon a kind of heath, native to the locality, which is found in situations quite as exposed, both to sun and wind, as are the slopes mentioned above.

The following tables show in detail the cost of the operations during the year, the plant in use, and the average daily number of employés of each class:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Sand, per cubic yard.
On scows or canal boats alongside of dock	$0.96137	$1.38601	
Unloading into cars	.02579	.14679	
Hauling to yard or shed	.00677	.03809	
Storing in yard or shed	.01666	.08596	
Hauling sand			$0.13043
Cost of material delivered at works	1.01059	1.65685	0.13043

NOTE.—The first cost of cement and concrete stone for the year, in the above table, is obtained by combining the prices under the contracts of the Lawrence Cement Company (terminated July 25, 1892) and Calvin Tomkins for cement, and those of John A. Bouker (terminated July 29, 1892) and Calvin Tompkins for concrete stone, as follows:

Cement.

Lawrence Cement Company, 8,933 barrels, at $1.02	$9,111.66
Calvin Tomkins, 23,410 barrels, at $0.939	21,981.99
	31,093.65

Or $0.96137 per barrel.

Stone.

John A. Bouker, 4,886.60 cubic yards, at $1.63	$7,965.16
Calvin Tomkins, 12,102.07 cubic yards, at $1.28½	15,581.42
	23,546.58

Or $1.386 per cubic yard.

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE.

Composition: 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry, machine mixed and deposited by derrick.

Material.

Broken stone, 0.92 cubic yard	$1.52430	
Cement, 1.43 barrels	1.44514	
Sand, 0.37 cubic yard	.04826	
		$3.01770

Manufacture and deposit.

Charging and running mixer	$0.35171	
Delivering under derrick	.09952	
Hoisting	.17597	
Placing and tamping	.31734	
Making and setting up forms	.22374	
Lumber and nails	.05217	
		1.22045
Total cost per 1 cubic yard		4.23815

III. TOTAL COST FOR ONE CUBIC YARD OF CONCRETE, INCLUDING COST OF REPAIRS AND MAINTENANCE OF PLANT, MOVING AND RIGGING DERRICK, TRACK WORK, MOVING AND SETTING UP MACHINERY, REPAIRS TO BUILDINGS, MAINTENANCE OF PUBLIC ANIMALS, SUPERINTENDENCE AND OFFICE EXPENSES, PURCHASE OF MATERIAL FOR OPERATING PURPOSES, EXCAVATION FOR COUNTERSCARP WALL AND GALLERIES, AND COST OF MATERIAL AND LABOR OF PLASTERERS IN FINISHING WALLS AND FLOORS.

Concrete masonry, 13,827 cubic yards, at $4.23815	$58,600.90
Repairs and maintenance of plant	1,621.92
Moving and setting up derricks	1,381.10
Moving and maintenance of track	769.29
Moving and setting up machinery	471.97
Repairs to buildings	674.83
Superintendence and office expenses	1,410.60
Purchase of material for operating purposes	1,694.56
Maintenance of public animals	611.55
Grading ditch and excavating foundation for counterscarp wall and galleries	1,292.13
Work of plasterers and cost of cement used in finishing counterscarp wall and galleries, and floors and walls of main gallery and magazines	2,246.03
Total cost	70,774.88
Total masonry constructed during the year, cubic yards	13,827
Total cost of masonry constructed	$70,774.88
Cost per one cubic yard	$5.1186

IV. COST PER ONE CUBIC YARD OF SAND EXCAVATED BY HAND AND GRAPPLES, HAULED AND PLACED IN EMBANKMENT INSIDE COUNTERSCARP WALL.

61,096 cubic yards sand excavated by grapple and loaded, at $0.06851 per cubic yard	$4,185.69
Hauling and placing same in embankment, at $0.06901 per cubic yard	4,216.23
57,382 cubic yards sand excavated and loaded by hand, at $0.08522 per cubic yard	4,890.09
Hauling and placing same in embankment, at $0.07827 per cubic yard	4,491.29
Total cost	17,783.30
Total cubic yards placed in embankment	118,478
Cost of excavating, loading, hauling, and placing same in embankment, per cubic yard	$0.150094

V. TOTAL COST PER ONE CUBIC YARD OF SAND EXCAVATED, HAULED, AND PLACED IN EMBANKMENT, INCLUDING COST OF PURCHASE AND MAINTENANCE OF PLANT, MOVING AND SETTING UP DERRICKS, MOVING AND REPAIRS OF TRACKS, MOVING AND SETTING UP MACHINERY, BUILDING TRESTLE TO FACILITATE THE DEPOSIT OF SAND, GRADING SLOPES OF EMBANKMENTS, CLEARING AND GRUBBING BORROW PITS, REPAIRS TO BUILDINGS, MAINTENANCE OF PUBLIC ANIMALS, PURCHASE OF MATERIAL FOR OPERATING PURPOSES, AND SUPERINTENDENCE AND OFFICE EXPENSES.

Sand filling, 118,478 cubic yards placed in embankment, at $0.150094 per cubic yard	$17,783.30
Purchase and maintenance of plant	5,175.37
Moving and setting up derricks	2,437.46
Moving and repairs of tracks	1,885.93
Building trestle to facilitate the deposit of sand	870.29
Grading slopes of embankment	811.13
Clearing and grubbing borrow pits	602.09
Repairs to buildings	314.78
Maintenance of public animals	634.84
Purchase of material for operating purposes	594.89
Superintendence and office expenses	1,694.57
Total cost of sand filling	1,285.60
Total sand placed in embankment during the year, cubic yards	34,090.25
Total cost per 1 cubic yard	118,478
	$0.28773

VI. TOTAL EXPENDITURE FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

13,827 cubic yards concrete masonry constructed, at $5.1186 per cubic yard	$70,774.88
118,478 cubic yards sand excavated and placed, at $0.28773 per cubic yard	34,090.25
1,381 linear feet drain pipe laid, cost of labor and material	684.17
Cutting and hauling sod for revetment of sand slopes	559.34
Cost of material and labor, building doors for counterscarp galleries and magazines	345.74
Cost of material and labor for embrasure armor, counterscarp galleries	209.23
2,268 square yards top slopes of main and transverse galleries covered with waterproofing material, at 25 cents per square yard	567.00
Total expenditure	107,230.61
Amount expended to June 30, 1892	102,407.87
Amount expended during fiscal year ending June 30, 1893	107,230.61
Total amount expended to June 30, 1893	209,638.48

VII. AVERAGE DAILY NUMBER OF EMPLOYÉS OF EACH CLASS FOR THE YEAR.

Overseers	1	Monthly laborers	0.43
Clerk	.08	Watchman	.23
Draftsman	.25	Blacksmiths	.6
Locomotive engineer	.83	Carpenters	5
Engineers	5.71	Plasterers	.9
Firemen	5.98	Stonecutters	.0
Riggers	.83	Teamsters	2.8
Master laborers	4.90	Laborers, daily	73.1

VIII. AVERAGE PLANT IN DAILY USE FOR THE YEAR.

Locomotives	.75	Dump cars	9.
Hoisting engines	4.91	Flat cars	14.
Stationery engines	.41	Bucket grapples	.
Concrete mixers	.83	Horses	3.
Derricks	4.75		

For purposes of comparison, the following tables I and II, showi detailed cost per cubic yard of concrete, from the annual report of la year, are here inserted:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Sand per cu yard.
On scows or canal boats alongside of dock	$1.02	$1.63	
Unloading into cars	.0227	.1211	
Hauling to yard or shed	.0032	.0193	
Storing in yard or shed	.0161	.0273	
Hauling sand			$0.
Cost of material delivered at works	1.0620	1.7977	0.

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE

Composition, 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry in pl machine mixed, and deposited by derrick.

Material.		
Broken stone, 0.92 cubic yard	$1.6539	
Cement, 1.43 barrels	1.5187	
Sand, 0.37 cubic yard	.0437	
		$3.2163
Manufacture.		
Charging and running mixer	0.29310	
Delivering under derrick	.08315	
Hoisting	.11224	
Placing and tamping	.22838	
Making and setting up forms	.12286	
Lumber and nails	.06532	
		.90505
Cost per cubic yard		4.12135

The cost of a cubic yard of concrete for the fiscal year ending June 30, 1893, was $4.23815; that for the last year, $4.12135; the increase in cost was therefore about 11 cents per cubic yard. The cost of material was much less (about 20 cents per cubic yard). The cause of the increase in cost was due to the nature of the work done, as will be apparent from a comparison of the tables.

It was necessary for a part of the time to double the mixing plant, though in so doing the output was not doubled; that is, two concrete mixers, operated by separate engines, were in use for about three months, but in default of adequate transportation the full manufacturing capacity of which each was capable was not attained. To this fact may be ascribed the increased cost of "charging and running mixers."

The next three items in the table may be consolidated under the general term "placing;" all show an increase over last year. This was due to the nature of the construction; the material was largely placed in the counterscarp wall, which is over 2,200 feet long and 15 feet high, with a thickness of 7 feet at the bottom and 3 feet at the top; the concrete had, therefore, to be distributed over a long line, increasing the haul and necessitating the frequent shifting of derricks, and deposited in restricted areas, which involved shoveling the concrete from the boxes.

The increase in the cost of "making and setting up forms" is due to the increased quantity of this class of work relative to the number of cubic yards of concrete constructed. The average thickness of the counterscarp wall is 5 feet, and that of all the other walls is 9 feet; therefore, the forms corresponding to 1 yard of masonry of the counterscarp wall should exceed in cost those for 1 cubic yard of the wall, having the greater thickness by about four-fifths.

The excavation, transportation, and deposit of sand in the embankments has been carried on by two methods; in the first the sand was shoveled by hand upon cars with removable boxes, having a capacity of about 1 cubic yard; these cars were then run under derricks, by means of which the car boxes were raised and dumped as desired. The other method was to load rotary dump cars of 3 cubic yards, capacity by grapples operated by steam, to haul the car up an incline by steam, and to dump it by hand.

The difference in cost of excavating and loading sand by grapple and by hand, as given in Table IV—1.67 cents per cubic yard—would have been greater had the facilities for transportation been such as to enable the grapple buckets to work up to their full capacity. One such grapple will excavate and load about 500 yards of sand in eight hours, under favorable conditions, while from the lack of proper plant for transportation purposes the greatest output per grapple here has not exceeded 350 cubic yards for the same number of hours.

The accompanying drawing, Pl. II,* shows the location of the three borrow pits from which sand was obtained, relative to the battery, and the successive location of tracks, derricks, etc., during the year.

On September 2, 1892, detailed plans and estimate of cost were submitted for the construction of the counterscarp galleries, designed for the defense of the ditch. These were approved by the Chief of Engineers September 15, 1892.

During the year a suitable drainage system for the battery was devised, the material for which was purchased, in accordance with law, at a cost of $355.14, and at the close of the fiscal year was all in place, excepting about 400 feet. The arrangement of this system, and the size and inclination of pipes, etc., are shown upon the accompanying drawing, Pl. III.*

The drainage is discharged into the swamp about 500 feet southwest of the battery.

As a matter of professional interest I desire to invite attention to the manner of constructing the counterscarp wall and galleries adopted by Lieut. Warren to obtain a smooth surface, and one which is apparently weatherproof. The plan originally followed was to build all the concrete masonry in forms of undressed spruce lumber, and then, on removal of the forms, to plaster the exposed face with cement. This coat of plaster could not be made to adhere to the older masonry, which rapidly absorbed its moisture, weakening the bond between the two, which was destroyed by the first cold weather, when the coating cracked and dropped off, much to the injury of the appearance of the work.

There was no economy in the use of the spruce lumber, which warped out of shape when subjected to the moisture of the concrete and could seldom be used more than once, and the plastering was very expensive.

It was decided to substitute forms made of first quality dressed white pine, grooved on both edges, and united by loose tongues of yellow pine, and to construct the masonry as follows:

That portion of the masonry next to the form, 4 inches thick, was put in without stone, the proportion of sand and cement remaining the same as in the concrete proper, securing a perfect bond between the face and the back of the wall. The forms being removed while the work was comparatively fresh, a little rubbing with a float gave a smooth surface to the face.

The counterscarp wall and the galleries, constructed in this way, have withstood an unusually severe winter without scaling or cracking.

Four spring return mortar carriages were transferred by the Ordnance Department to the Engineer Department June 10, 1893, for mounting upon four of the eight mortar platforms to be constructed in compliance with instructions of the Chief of Engineers dated March 10, 1893. It is proposed to mount them upon the platforms of the northeast mortar pit, the masonry of which has been constructed longer than that of the other pits, and the inner slopes of which can be most conveniently completed first.

The base rings and bed plates for these mortar carriages are single castings, 14 feet in diameter, and weighing about 17 tons each. The dimensions prevent their passage through the transverse gallery joining the mortar pits, and it will be necessary to take them over the embankments surrounding the pits. This will be done at an ear-

* Omitted.

date, using the trestle constructed for moving sand, and every effort will be made to have the four carriages ready for their mortars on or before September 1, 1893.

1 B.

GUN-LIFT BATTERY No. 1.

Gun-Lift Battery No. 1 is arranged for two 12-inch, high-power, breech-loading rifled guns.

The estimated cost of the masonry and sand covering for a battery of this type, containing two guns, is $283,000. (Report of The Board of Engineers, September 8, 1890.)

The estimated cost of a single gun lift, including hydraulic ram and fittings, is $61,980, and that of the hydraulic power for not exceeding two lifts is $50,570, making the total estimated cost of the mechanism for a single lift $112,550, or for two lifts $174,530. (Letter from Chief of Engineers, February 20, 1890.) Trial may show that for the proper maneuvering of two lifts one additional pump will be required at an estimated additional cost of $2,590.

The estimated total cost of a completed battery of this type for two guns is therefore $457,530.

Excavations for the foundations of the northern half of the battery were commenced in January, 1891, under instructions from the Chief of Engineers dated February 20, 1890, and September 13, 1890, and on April 3, 1891, further instructions were received for the construction of the southern half of the battery.

From the appropriations of August 18, 1890, and February 24, 1891, for gun and mortar bateries, allotments of $154,000 and $129,000, respectively, were made for the construction of the masonry and the sand covering of one battery complete. From the appropriation of September 22, 1888, for armament of fortifications, an allotment of $12,500 was made for the construction of the mechanism and hydraulic motors for one lift, and from the appropriations of February 24, 1891, and July 23, 1892, for gun and mortar batterries, an allotment of $63,000 was made January 26, 1893, for the construction of the mechanism for the second lift as follow:

Appropriation of February 24, 1891	$9,087.43
Appropriation of July 23, 1892	53,912.57
Total	63,000.00

At the close of the last fiscal year the condition of the work was as follows:

The total quantity of masonry in place June 30, 1892, was 32,930.5 cubic yards.

All the parts of the gun-lift mechanism had been completed, delivered at the work, and so far adjusted as the condition of the masonry admitted.

At the beginning of the fiscal year, July 1, 1892, the following contracts were in force:

1. With the Lawrence Cement Company, dated December 29, 1890 (expired January 1, 1892, extended to August 1, 1892), approved by

the Chief of Engineers January 12, 1891, for the delivery of 30,000 barrels of cement, at $1.02 per barrel. Completed July 25, 1892.

2. With John A. Bouker, dated December 29, 1890 (expired January 1, 1892; extended to November 1, 1892), approved by the Chief of Engineers January 8, 1891, for the delivery of 21,000 cubic yards of broken granite, at $1.63 per cubic yard. Completed July 29, 1892.

* * * * * * *

4. With James Rudolph, dated May 31, 1892 (approved by the Chief of Engineers June 10, 1892), for the construction of a frame dwelling for the general use of the Engineer Department, at a cost of $5,000, including the services of the architect. This contract was completed July 30, 1892.

During the fiscal year the following additional contracts were made:

1. With the General Electric Company, dated November 23, 1892 (expired February 1, 1893; extended to March 1, 1893), approved by the Chief of Engineers December 20, 1892, for the installation of an electric-light plant, at a cost of $3,788. Completed March 10, 1893.

* * * * * * *

3. Under sealed proposals opened July 20, 1892, a contract was made July 22, 1892, with Calvin Tomkins, of New York, the lowest responsible bidder, for the delivery of 25,000 barrels "Old Newark" Rosendale cement, at 93.9 cents per barrel, and 20,000 cubic yards of broken stone, at $1.28¾ per cubic yard.

There have been delivered under this agreement up to June 30, 1893, 12,102 cubic yards of broken stone and 23,410 barrels of cement, of which amounts 102 cubic yards of broken stone and 3,637 barrels of cement were applied to the construction of the masonry at the Gun-Lift Battery.

The construction of the masonry was continued throughout the year, excepting the period from December 1, 1892, to May 1, 1893, during which the weather conditions rendered a suspension of such work necessary.

The battery, with the exception of the mechanism for the southern lift, *is practically completed.*

The hoisting and overhead carrying apparatus for the ammunition service are not in place, and the large doors for the main entrance are yet to be built and hung; all the material for these is either on hand or ordered for early delivery.

The total amount of masonry constructed during the year was 8,292.9 cubic yards, at a cost of $4.706 per cubic yard.

This includes 1,512 cubic yards of large stone bedded in the concrete and designed, by rendering the masonry nonhomogeneous, to deflect hostile projectiles; 538.3 cubic yards of cut granite, and 898.25 cubic yards of pavement of the interior and exterior of the battery.

The embankment of sand which rests against the exterior 20-foot wall and surrounds the battery, excepting at the defensible entrance (placed in rear of the battery and at the middle point), was also constructed during the year. The amount of sand excavated, hauled, and deposited therein was 5,185 cubic yards.

All of this work—masonry and earth construction—was done by hired labor, after the purchase of material by sealed proposals invited according to law.

The following tables show in detail the cost of construction, the plant in use, and the average daily number of employés of each class:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Large stone, per ton.	Sand, per cubic yard.
On scows or canal boats alongside dock	$1.0088	$1.583	$0.790	
Unloading into cars	.02424	.12649	.396	
Hauling to yard or shed	.00304	.02422	.101	
Storing in yard or shed	.01707	.05213		
Testing cement	.00762			
Placing large stone in wall			.197	
Hauling sand				$0.11251
Total cost	1.06077	1.78584	1.484	0.11251

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE.

Material.

Broken stone, 0.92 cubic yard	$1.64297	
Cement, 1.43 barrels	1.51691	
Sand, 0.37 cubic yard	.04163	
		$3.20151

Manufacture and deposit.

Charging and running mixer	$0.269734	
Delivering under derrick	.094380	
Hoisting	.149290	
Placing and tamping	.183840	
Making and setting up forms	.176680	
Lumber and nails	.060750	
		0.934674
Cost per cubic yard		4.136184

Composition, 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry in place, machine mixed and placed by derrick.

III. TOTAL COST OF COMPLETING THE MASONRY IN BATTERY, AMOUNTING TO 42,410.45 CUBIC YARDS, DIVIDED AS FOLLOWS:

39,012.65	cubic yards concrete masonry, at $4.13618 per cubic yard	$161,363.34
1,525	cubic yards large broken stone, bedded in concrete, at $3.333 per cubic yard	5,082.82
538.3	cubic yards cut granite masonry, at $36.1711 per cubic yard	19,470.94
487	cubic yards in finished pavement of superior slope (Alsen's Portland cement), comprising an area of 1,096 square yards, at $3.11814 per square yard	3,417.48
411.25	cubic yards in finished pavement of exterior and interior slopes (Duryea's American Portland cement), comprising an area of 1,645 square yards, at $2.3757 per square yard	3,908.02
128.75	cubic yards in finished floors of galleries, and rooms (with Rosendale cement), comprising an area of 965.5 square yards at $1.41 per square yard	1,361.35
307.50	cubic yards bluestone pavement of terreplein entrance passage and boiler room, comprising an area of 1,845 square yards, at $2.70572 per square yard	4,992.07
42,410.45	cubic yards. Total cost	199,596.02

42,410.45 cubic yards completing masonry construction, at $4.706293 per cubic yard.

IV. TOTAL EXPENDITURE TO JUNE 30, 1893.

42,410.45 cubic yards masonry, at $4.706293	$199,596.02
Purchase and maintenance of plant, etc	23,850.34
Excavation for foundation, 5,177 cubic yards, at $0.251	1,299.43
Work of plasterers finishing interior walls and arches	1,453.87
Repairs to buildings	3,881.93
Purchase and maintenance of public animals	1,231.45
Sand filling in exterior slope, 5,185 cubic yards, at $0.22235	1,152.93
Material and labor finishing pavement of superior slope with Duryea's American Portland cement, 1,096 square yards, at $1.7924	1,964.47
Removing pavement of Duryea's American Portland cement from superior slope	258.75
Grading exterior sand slope and adjacent grounds	100.82
Track and derrick work	1,513.85
Building and hanging doors for magazines and casemates	1,241.33
Tearing out stone bins, cement sheds, etc., and clearing up refuse	1,545.06
Whitewashing interior walls and arches	411.21
Material and labor, laying drain pipe	172.11
Material and labor, putting in plant for permanent water supply	720.40
Material and labor, ammunition service, cars, track, and turntables	1,212.38
Material and labor, operating and maintaining gun-lift mechanism	2,083.31
Material and labor, mounting 12-inch rifle	1,073.31
Fastening pintle plate to platform and assembling Creusót carriage	381.25
Material and labor fitting dynamo room and making steam connections for electric-light plant	226.16
Installation of electric-light plant	3,788.00
Three iron stairways, interior of battery	710.00
Iron cover of south lift loading gallery	250.00
Iron beams in floor of caponiere	180.49
Applying waterproofing process, 2,686 square yards, at $0.25	671.50
Iron-cover plates of pipe conduits	66.32
Purchase of material for operating purposes	752.83
General work, etc., consisting of items not susceptible of classification, and including time allowed employés for legal holidays	9,832.89
Office expenses	2,714.62
Superintendence and clerk hire	6,648.50
Total expenditure to June 30, 1893	270,985.73
Total expenditure	270,985.73
Total masonry cubic yards	42,410.45
Total cost per 1 cubic yard	6.38959

V. AVERAGE DAILY NUMBER OF EMPLOYÉS OF EACH CLASS FOR THE YEAR.

Overseers	1.54	Watchman	.29
Clerk	.91	Teamster	.79
Draftsman	.75	Blacksmith	1.35
Recorder	.804	Plasterers	2.2
Locomotive engineer	.17	Carpenters	3.10
Engineers	3.25	Stone cutters	6.35
Rigger	.17	Stone setters	1.
Master laborers	2.58	Laborers, daily	39.
Monthly laborers	.83	Firemen	2.

VI. AVERAGE PLANT IN DAILY USE FOR THE YEAR.

Locomotive	.25	Dump cars	3.
Hoisting engine	1.50	Flat cars	5.
Stationary engines	.83	Derricks	3.
Concrete mixers	.75	Horses	1.

During the last fiscal year the general plan of the battery ha received the following additions and modifications:

1. No special arrangements had been provided for the handling either for storage or for service in action, of the ammunition. Th

t of the projectiles for the 12-inch rifles designed for mounting
the battery, 1,000 pounds, obviously necessitated the employment
chanical power for their economical and speedy handling, and the
nt of powder required to fill the magazines (45 short tons) could
e well transported without special facilities.

these reasons a plan was submitted on September 27, 1892, for
hing the necessary conveniences while making use of a portion
plant acquired for construction purposes. This plan, as modi-
y The Board of Engineers October 13, 1892, and finally approved
Chief of Engineers October 15, 1892, has been carried out as
ows:

construction track (36-inch guage) from the engineer wharf runs
gh the entrance of the battery to the transverse gallery connect-
ie magazine passage ways, where a turntable is placed, from
a track leads, right and left, to points opposite the entrances to
agazine passage. This track is of steel girder rails, 72 pounds
yard, built into the concrete floor. Through the magazine pas-
ay, crossing the track above described at right angles and extend-
the ram of the ammunition hoist, runs another track of the same
(36-inch), but with rails composed of gun metal straps, 2 inch
e-half inch, screwed with brass screws to creosoted yellow-pine
ers, 4 inches by 4 inches, bedded in the concrete floor. A turn-
is placed in the line of this track opposite the magazine entrances,
which tracks, constructed as above, run directly across each maga-
An ammunition car of 6 tons capacity, with gun-metal wheels,
een provided for use inside the magazine passages and maga-

s system of tracks and turntables will allow the ammunition,
l upon flat cars from a lighter at the wharf, to be delivered at the
ices to the magazine passages. There it will be transferred to
mmunition car by an overhead trolley and hoist of 2,000 pounds
ity attached to the crown of the arch of the transverse gallery.
ansfer completed, the car can be run directly into the magazines.
agazines designed for the storage of shells are provided with an
ead traveling bridge, trolley, and hoist, which will enable one man
idle a load of 2,000 pounds at any point of the magazine. The
er cylinders, weighing but 150 pounds each, can be piled by hand.
combined ammunition carriage and loading tray, forming part of
echanism of the lift, can, by the same system, be run from its
over the ram of the ammunition hoist into the magazines, receive
wder and projectile, and have them conveyed to their final posi-
n the gun entirely by mechanical power.

As originally planned the battery was to have been lighted by oil
placed in suitable recesses constructed in the walls. The mag-
e of the work, its many passages and casemates, make it apparent
while the system above described would be useful as an auxiliary
ld not supply a good working light. It was therefore proposed
vide a suitable electric-light plant. This has been done.

plant is of the same general type as that in use by the Navy
tment on vessels of war.

onsists of a direct coupled Thomson-Houston engine and dynamo,
g a capacity, with 80 pounds of steam and running at 550 revolu-
per minute, of 100 volts and 40 amperes, equivalent to about eighty
dle-power lamps. Connected with this there are four 24-candle-
lamps, one in each magazine, and fifty-four 16-candle-power lamps,

The excess of power will be utilized in running electric fans for ventilation purposes should these prove essential.

The conductors are all lead-covered and run in moldings attached to the concrete wall and arches by brass expansion bolts. Every lamp is covered with steam and vapor proof globes and protected with metal guards. Steam is taken from the main boilers.

The plant is compact, simple, and durable, and has so far proved itself well adapted to its purpose. Its total cost installed was $4,014.16.

3. The specifications for the manufacture of the mechanism of the gun lift required that the final payment of 25 per cent should not be made until after it had stood satisfactorily a working test, in connection with its hydraulic appliances, weighted with its equivalent ultimate load in case the gun and gun carriage were not mounted at the time the structure was ready for test.

The gun and carriage were delivered and mounted immediately after the lift was ready for them, and the test, which began, as hereinafter stated, September 12, 1892, was continued for five days, in the presence of a board of engineer officers especially convened for the purpose. A report on the subject was made by the board to the Chief of Engineers, dated December 7, 1892.

The mechanism withstood the test without a single evidence of weakness, and final payment was made to the contractor December 21, 1892.

The concrete composing the superior slope at the time of firing was only four days old, and hardly had time to begin settling under a freezing temperature before it was subjected to severe gun blasts, which materially injured it.

The experimental firing of the 12-inch rifle mounted upon the north lift demonstrated the practicability of raising the interior crest of the battery 18 inches without impairing its fire over the channels, for the protection of which it was designed.

As this would materially increase the cover, not only to the gun detachments but also to the loading galleries, it was decided to make the change.

Accordingly, the interior crest has been raised by the addition of a wedge-shaped mass of masonry having a depth of 18 inches at the rear (interior crest) and running out to nothing at the exterior crest.

The effects of blast upon this masonry indicated that certain improvements in the composition and laying of the concrete could be wisely adopted on the reconstruction of the superior slope, necessitated by its elevation, as above reported.

Like all concrete structures the parapet of this battery is composed of successive layers of masonry from 4 inches to 8 inches in thickness, and, as is well known, the weak point in this class of work is the bond between successive layers. This was markedly shown in the present instance. The blast of the gun first destroyed the bond between the upper layers of concrete, and the effect of successive shots was to break these layers into smaller fragments, and finally, when sufficiently broken up, to wholly displace them.

In reconstructing the slope all concrete masonry showing signs of weakness was first removed. Then the masonry was built up in sections, the successive layers of which were superposed before the underlying ones had time to set. This method had for its object the making of the blocks equally strong throughout and the substitution of vertical joints for the horizontal ones. The material used was Alsen's Portland

cement and fine crushed granite, mixed by machine in the proportion of two parts of cement to three parts of stone, and carefully rammed in place, taking the precaution, while still fresh, to float the upper surface with dry cement and sand. The resulting surface is smooth and exceedingly hard. The thicknesss of the masonry of the nature above described was varied in proportion to its exposure to blast—from 12 inches directly under the gun to about 2 inches at the exterior crest.

To provide for the supply of water requisite for boilers, hydraulic system, and for purposes of cleanliness, a "Rider" hot-air pumping engine has been placed in a bomb-proof room, 7½ feet by 9 feet, situated under the sand embankment adjoining the defensible entrance on the right, and communicating with it by a doorway cut through the concrete wall. This pump has a capacity of 1,000 gallons per hour, which is ample, as the boilers of the lift mechanism evaporate but 500 gallons per hour, and the tank for supplying the hydraulic system (capacity 1,500 gallons) requires filling only occasionally. The pump is connected by a line of galvanized-iron pipe to a group of four 1½-inch well points sunk about 175 feet in rear of the battery.

On the left of the defensible entrance, covered by the sand and opposite the pump room described above, there has been constructed another bomb-proof room, 7½ feet by 16½ feet, to provide space for a suitable sanitary water-closet for the garrison when the work is occupied.

Flagstones taken from the old stone fort have been used to pave the terreplein of the battery, the floors of the boiler and accumulator rooms, the space included between the rails of the tracks for the ammunition service, and the exterior court included between the wing walls of the defensible entrance. In all, 16,605 square feet of such pavement were laid at an aggregate cost of $4,992.07.

GUN-LIFT MECHANISM.

North Lift.—As already stated, the mechanism of the northern lift was completed and reported ready for trial August 30, 1892. Prior to this, preliminary trials of the several parts had been made as the progress of the work allowed. The cage and platform were raised and lowered for the first time on July 7, 1892. The first trial of the mechanism—gun lift, ammunition hoist, and hydraulic rammer, as a whole—was made on August 31, 1892.

The official test of the mechanism was commenced on September 12, 1892, in the presence of a board of officers of the Corps of Engineers, convened for this purpose by Special Orders No. 43, Headquarters, Corps of Engineers, U. S. Army, Washington, D. C., September 3, 1892.

The test was continued November 22, 23, and 30, and December 1, 1892.

While the report of this board contains a detailed account of the tests, it is thought that the following tabular statement of the firings from the battery to June 30, 1893, should be here reported:

Date.	No. of shot.	Charge.		Weight of projectile, solid shot.	Instrumental velocity, 250 feet from muzzle.	Elevation or depression.	Pressure in pounds per square inch of bore.
		Kind of powder.	Weight.				
1892.			*Pounds.*	*Pounds.*	*Foot secs.*	° ′	
Sept. 12	1	V. P. XIV	200	1,000		3 25	14,929
Sept. 12	2	do	300	995	1,639	05	23,210.5
Nov. 22	3	do	200	996		2 00	14,892.5
Nov. 22	4	V. P. X	200	1,000		2 00	P 9,857; X less 9,000
Nov. 22	5	V. P. XV	300	1,000		2 00	22,809
Nov. 23	6	do	325	1,002	1,658	0 00	25,050
Nov. 23	7	do	375	998	1,797	0 00	30,182
Nov. 23	8	V. P. X	375	993		10 00	27,730.5
Nov. 30	9	V. P. XV	200	997		10 00	12,011.5
Nov. 30	10	V. P. XIV	390	995	1,915	0 00	40,501.5
Nov. 30	11	V. P. XI	460	1,000		15 00	32,725
Dec. 1	12	do	460	1,000		19 40	32,786
Dec. 1	13	V. P. XV	423	1,000	1,917	0 00	33,777.5
Dec. 1	14	B. N. smokeless	204	999	1,047	0 00	28,038.5
1893.							
Mar. 15	15	V. P. XV	350	999	1,749	Depression 0 25	27,170
Mar. 15	16	do	400	999	1,904	0 25	42,000
Mar. 15	17	do	390	999	1,843	0 25	34,800
Mar. 31	18	V. P. XVI	350	1,000	lost	0 25	27,672.5
Mar. 31	19	do	400	1,002	1,846	0 25	34,650
Mar. 31	20	do	420	1,002	1,923	0 15	44,000
Apr. 24	21	V. P. XVII	350	1,002	1,922	0 15	about 73,600
May 31	22	V. P. XVIII	300	1,000	1,700	2 35	25,375
May 31	23	do	350	1,000	1,808	2 35	31,925
May 31	24	do	420	1,000	1,910	0 12½	36,900

From this table it will be seen that in all twenty-four rounds have been fired from the platform of the lift. Many of these, notably the twenty-first round, subjected the structure to stresses far in excess of any probable under service conditions; notwithstanding these excessive stresses, the mechanism has invariably worked smoothly and satisfactorily, and shows no signs of weakness in any part. During all the tests, there has been no delay of any kind due to the failure of the lift or its adjuncts to do the work required of them.

The official trials of the mechanism showed the desirability of some minor changes, mainly in the loading apparatus; these modifications, described below, were all made by the contractors at the suggestion of this office, and without any additional expense to the United States:

1. It was necessary to increase the speed of travel of the hydraulic rammer. The proper service of the gun requires that the projectile be so far driven home as to partly upset its rotating band in the grooves of the rifling. This condition, unknown when the rammer was designed, was not satisfactorily fulfilled, and, the weight of the rammer being fixed, the increase of its energy could be effected only by increasing the rate of travel. This was done by increasing the annular space through which the water escapes to the rear during the forward movement, so as to make this area equal to that of the inlet pipe.

2. The combined ammunition carriage and loading tray, and the auxiliary loading tray which forms the connection between the ammunition carriage and the breach of the gun when in the loading position, were modified as follows: The two charge bags which are carried upon

arms on each side of the powder tray of the ammunition carriage are now successively dropped into position, in front of the rammer, by a single motion of the operator. The auxiliary loading tray, operated by hydraulic power, is controlled by the same operator as are the ammunition hoist and hydraulic rammer. The effect of the changes will be to diminish the time required for loading.

3. The steel pin or throttling bar, which is placed in the top of the cylinder of the heavier of the two accumulators and which serves to gradually check its downward motion near the completion of the descent, was replaced by a longer one; this was deemed advisable, as in raising the lift at maximum speed it was found that the heavy accumulator seated with more force than was consistent with safety. The lengthening of the pin has removed this difficulty.

THE CARRIAGE.

As reported last year, all the parts of the gun carriage, designed and manufactured for use with the gun-lift mechanism, by Messrs. Schneider & Co., of Creusôt, France, was on the upper surface of the battery June 30, 1892. It was not until July 30, 1892, that the pintle or bed-plate of this carriage was finally attached to the platform of the lift. The lower surface of this plate was irregular, and it was necessary to do a great amount of chipping upon the upper surface of the platform before it was practicable to so adjust the pintle plate as to bring its limiting lines, the circles bounding the lower roller path, into horizontal planes.

This effected, the remainder of the carriage was assembled. This work was all done by the employés of the Engineer Department, excepting the insertion and adjustment of the rams in the recoil and reservoir cylinders and the adjustment of the obturating bars and the pump, which were effected by one machinist and helper furnished by the Ordnance Department.

The carriage was completely assembled ready for the gun on August 15, 1892, at a cost divided as follows:

Labor	$229.25
Attaching pintle plate to platform Hold-down bolts	152.00
Total cost	381.25

THE GUN.

The 12-inch B. L. steel rifle was delivered by the Ordnance Department under the wall of the battery at a point indicated by the engineer officer in charge, at 4 p. m., August 23, 1892. It had been placed on a cradle August 12, at a point about 1,200 feet from that of delivery, from which latter point it was delivered at the battery in ten working days.

The work of erecting the appliance designed for raising it had already been completed, as far as was practicable, prior to the delivery of the gun.

Final arrangements for raising and mounting the gun were completed on August 25, and the gun was successfully delivered on the wall of the battery, immediately in front of the lift platform, at noon on August 26.

The gun was finally placed upon its carriage and raised to the firing position by the hydraulic lift, at 7:30 p. m., Monday, August 29, 1892.

There are forwarded herewith, among others, a set of photographs* illustrating the method used for raising the gun.

The device for raising the gun, adopted and so successfully used by Lieut. Warren, may be briefly described as follows: A frame of timber, having a width between uprights slightly greater than that of the gun (measured from end to end of trunnions), was placed parallel to the wall of the battery and distant from it about 13 feet—6 inches greater than the distance of the axis of the trunnions from the face of the breech of the gun.

From the cap of this frame a steel bar about 4 inches in diameter (the eccentric axle of an old gun carriage) was suspended by three wrought-iron bands, from which were hung two blocks, one with four, the other with three, sheaves, through which and their falls was rove about 750 feet of 7½-inch manilla rope, the standing part being made fast to the cap of the frame and the running part passing first through a single block secured to the bottom of one of the timber uprights, and thence to a secure anchorage. The gun, without preponderance, the breech-block being removed, was slung to the falls by 1¾-inch wrought-iron chain, the breech to the wall. Parallel to the frame first described, four smaller frames were so arranged that when capped they would form a platform at the elevation at which the gun was to be delivered. These frames were securely braced together and to the larger frame, and the whole structure tied and braced to the masonry of the battery.

Leads were taken from two hoisting engines near at hand, which formed part of the construction plant, to the running part of the 7½-inch manilla rope, using two parts of half-inch steel-wire hoisting rope.

The object in connecting the two engines was to avoid any stoppage in the raising of the gun when once commenced, from shifting the purchase, or "fleeting" as it is technically known.

The gun was then raised vertically above the level of the auxiliary platform, the caps promptly put upon the frames, stringers laid over the caps, a cradle run out upon these from the wall, and the gun lowered upon the cradle, which was then hauled in upon the masonry by means of a lead from one of the hoisting engines above referred to.

Sixteen parts of 7½-inch rope were used, the safe load for a single part being 12 tons, and as the load to be lifted was 52 tons, the factor of safety was therefore about four; on the steel-wire rope the same proportions existed, while the framing was calculated with a factor of safety of six.

The actual time required to hoist the gun was one hour and forty-three minutes and the actual time of motion was twelve minutes and twenty-five seconds—a rate of 1 foot in thirty-nine seconds. The delay is attributable to the fact that the cordage was saturated with water, which rendered it extremely stiff and made it difficult and slow work to take up the slack of the main anchorage.

The operation was performed in a pouring rain, which had been falling for the preceding twenty-four hours.

SOUTH-LIFT MECHANISM.

The mechanism designed for the southern emplacement of the battery is to be, in all respects, a duplicate of that now in place in the northern emplacement.

Sealed proposals for its manufacture, advertised according to law

* Omitted.

mber 21, 1892, were opened January 24, 1893, and the contract was ded for the sum of $63,000.

ıder their contract, dated February 4, 1893, for the manufacture ɔrection of this mechanism, the contractors have on hand, June 30, all the material for its construction, and have commenced the minary work of assembling the parts forming the cage.

is expected that they will be ready to begin operations during the h of July, 1893, and to finish the erection of the lift by Septem-, 1893, as the contract requires.

carriage has yet been procured for mounting upon the platform e southern lift. It has, however, been decided that this carriage be a duplicate of that now in position on the north lift, and ar-ements have been perfected with the Ordnance Department by h the pintle plate of the carriage will be delivered not later than ɛmber 1, 1893. When this pintle plate has been attached to the orm of the southern lift the top carriage and gun now mounted the north lift will be shifted to the southern lift for use in the ɔf the mechanism of that lift, and for other tests required by the ance Department.

e recoil test will be five rounds by the 12-inch high-power gun, under service conditions of extreme charge of powder and extreme tion.

I C.

TORPEDOES FOR HARBOR DEFENSE.

CONSTRUCTION OF TORPEDO SHED.

ıns and estimate were submitted April 3, 1891, for the construc-ɔf a suitable building for the storage of torpedo material for the arine defense of New York Harbor, and the sum of $9,000 was ɛd for the work from the appropriation for torpedoes for harbor ıse, act of February 24, 1891.

e general character of this structure is as follows: The building brick, 40 feet by 90 feet, inside measurement, with walls 1 foot in ness and 10 feet high under the eaves. The roof is of slate, sup-d by eight iron trusses. The floor is of concrete, and the track of ɔnstruction railroad from the engineer wharf runs through the ing from end to end. On either side of this track are racks of h by 8-inch timber, arranged for the storage of buoyant torpedo in two tiers. A suitable storeroom for containing the smaller of the torpedo system is located in the southeastern corner of the ing, and an overhead hoisting and conveying appliance will be d at the eastern end of the building for handling the heavy ɔrs and ground mines.

the close of the last fiscal year the building was complete, except-he shelving, etc., in the storeroom and the overhead trolley.

e shelving in the storeroom has been left unfinished, pending the al of the material to be stored therein. The overhead trolley for ling the heavy torpedo material inside the shed has been ordered, will also be put in place at an early date.

APPENDIX No. 2.

GUN AND MORTAR BATTERIES, SAN FRANCISCO HARBOR, CALIFORNIA.

REPORT OF COL. GEORGE H. MENDELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

IMPROVEMENTS.

a Gun batteries. | *b* Mortar battery.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., August 7, 1893.

GENERAL: I have the honor to transmit herewith annual reports for the year ending June 30, 1893, as follows:

Gun and mortar batteries, San Francisco Harbor, California.

* * * * * * *

Very respectfully, your obedient servant.

G. H. MENDELL,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

2 A.

GUN BATTERIES.

The work is completed as far as can be done until details of the carriages to be used are received. The masonry of Emplacement 16 was completed; all the masonry of emplacements 14 and 15 laid; the earth protection, front and rear, on six emplacements was made; the roadway in rear was excavated, macadamized, and drained; floors of asphaltum, at 12½ cents per square foot, and of sidewalk concrete at 9½ cents per square foot, were laid in the six emplacements, the asphaltum in Emplacements 11 and 12, and the concrete in Emplacements 13, 14, 15, and 16; all masonary was plastered within and without, at 3½ cents per square foot; doors were made and hung; slopes carefully dressed and sown with oats and barley and manured. There remains to be done when mounting is known 1,107 cubic yards of concrete to be laid in

gaps in breastwalls; construction of terrepleins; 33,676 square feet of bituminous rock covering 3 inches thick, and 3,168 square feet of same 6 inches thick, to be laid over masonry; elevating machinery for Emplacements 14, 15, and 16, and overhead travelers for the six emplacements. There is also 110 feet of roadway to be finished, the making of which was obstructed by a cement shed built across the proposed line; this shed has been removed and the roadway will soon be completed.

A concrete plant purchased in 1891–'92 was used for mixing concrete. It consisted of one 50 H. P. boiler, one 35 H. P. Westinghouse Junior engine, one Gates No. 3 rock-crusher, one Ransome and Smith No. 3 concrete-mixer, and one Stearn's bucket elevator. The materials were dumped into hoppers feeding to the mixer, which automatically combines them in proper proportions, mixes them in a revolving churn, and delivers to boot of elevator, which raises them 32 feet to a hopper over the cars on a tramway above the top of masonry. This plant was run with occasional interruptions from July 1 to October 13. During this time 7,409 cubic yards was mixed and laid on Emplacements 14, 15, 16 (2,703 on Emplacement 16, and 4,706 on Emplacements 14–15). The plans for Emplacements 14 and 15 were changed by placing the magazines of both in a single mass of masonry between the terrepleins of both, with 6 feet interval between adjacent rooms of each. In giving quantities by emplacements in the report Emplacements 14 and 15 are treated as a single emplacement.

In addition to above concrete, 1,876 cubic yards was mixed by hand and 1,257 cubic yards of concrete from old magazines and breast walls was imbedded in the new; also 6 cubic yards of large rock was imbedded in the concrete, making total masonry for the year 10,548 cubic yards. This total was distributed over the emplacements as follows: Ninety-one cubic yards on Emplacement 11; 6 cubic yards on Emplacement 13; 7,032 cubic yards on Emplacements 14, 15, and 3,418 on Emplacement 16.

Concrete was made in proportions of 1 cement, 3 sand, and 8 rock; gravel was sometimes used and counted as rock when large and clean. The rock used was quarried at Angel Island, San Francisco Harbor, and delivered at wharf at 89 cents per 2,000 pounds. Gravel was obtained from Gravelly Beach and Horse-shoe Bend, Lime Point reservation, and delivered at wharf at 90 cents per cubic yard. The sand was obtained from Fort Point Beach and from the Presidio Beach; the latter was delivered at wharf at 50 cents per 2,000 pounds. The materials were hauled to the concrete plant by contract at the following prices:

		Cents.
Rock	per 2,000 pounds	29½
Gravel	do	29½
Cement	do	29½
Sand from beach or wharf	do	29½
Raising sand to sea wall from beach	do	25

The cement used was Josson & Co.'s Portland cement, furnished at $2 per barrel over ship's side, and lightered to wharf by A. C. Freese at 15 cents per barrel.

This gives cost of materials at plant as follows:

Rock, $1.28 per 2,000 pounds, or $1.73 per cubic yard (including 9½ cents per ton for receiving at wharf).

Gravel, $1 per 2,000 pounds, or $1.30 per cubic yard.

Sand from Fort Point Beach, 54½ cents per 2,000 pounds.

Sand from Presidio Beach, 79½ cents per 2,000 pounds.

Cement, $2.21 per barrel.

Materials used in concrete for the year.

Material.	Tons of 2,000 pounds.	Cubic yards.
Rock	10,278.4	7,613.7
Gravel	2,002.1	1,483.0
Sand	4,703.8	3,871.5
Cement	1,361.6	1,134.7

Average composition of one cubic yard.

Material.	Pounds.	Cubic feet.	Barrels.
Rock	2,215.6	22.2	
Gravel	431.6	4.3	
Sand	1,014.0	11.3	
Cement	293.5	3.3	0.78

The water used in concrete was fresh, and pumped to a reservoir whence it is drawn to the plant. The pumping was effected by a Dow steam pump, purchased in 1891–'92, with a capacity of 1,000 gallons per hour.

The earthwork during the year consisted mainly of filling in the slopes front and rear on the six emplacements and in excavating the roadway in rear. All of the excavated material was used in filling, and in addition, a large amount mainly loam was borrowed from the ground in rear of emplacements. The excavation amounted to 10,004 cubic yards, and was done at a cost of about 43 cents per cubic yard. The earth fill amounted to 19,922 cubic yards, and was done at a cost of about 33 cents per cubic yard. The sand fill required in plans in front of masonry was made partially of sand from Fort Point Beach and partially of a loamy sand hauled from dunes in rear of the works. It amounted to 4,712 cubic yards, and was done at a cost of $32\frac{8}{10}$ cents per cubic yard. The greater cost of earth fill is due to expense of dressing and the planting slopes.

The outlay during the year was as follows:

Concrete (10,547 cubic yards)	$35,876.85
Excavation (10,004 cubic yards)	4,304.60
Fill (23,946 cubic yards)	7,992.67
Plastering and flooring	1,883.08
Drainage and water supply	858.37
Macadam and gutters on roads, doors, ladders and steps	3,302.10
Incidentals: Office and post-office box rent, pay of overseer, timekeeper, draftsman, and messenger, etc	11,278.18
Total	65,495.85

Giving the concrete its proper proportion of incidental expenses ($7,462.38), adding $17,264.26 for cement on hand June 30, 1892, and subtracting $5,500 for cement on hand at completion of work, the cost of 10,547 cubic yards of concrete is $55,103.49, or $5.22 per cubic yard. The average cost per cubic yard of all concrete laid on works from beginning to end is $5.78.

2 B.

MORTAR BATTERY No. 1.

This battery is of the adopted type of 16-mortar battery for 12-inch breech-loading rifled mortars. Ground was broken for this battery on April 5, 1893, and work has been in progress on it ever since. The excavation was effected by plowing and scraping on the shallow portions and by blasting on the deeper ones. The excavation for the rooms and passages was completed June 20, and the excavation then ceased until concrete should be laid on this portion. The excavation during this time amounted to 10,781 cubic yards.

The concrete plant was moved to a position west of the battery, repaired and set up at a cost of $2,469, including tramway over excavation. The concrete plant was run from June 21 to June 30, inclusive, and during this time 507⅔ cubic yards was mixed and laid; 21 cubic yards of hand-mixed concrete was also laid, making a total of 528⅔ cubic yards. At the end of the year the excavated portion was covered with concrete 1 foot thick. Allowing the concrete its proper proportion of expenses on plant, it was laid at a cost of $4.18 per cubic yard.

The rock for concrete was obtained from a quarry on the Fort Point Beach and delivered at the plant by contract at $1.03 per 2,000 pounds. The sand was obtained from Fort Point Beach and delivered at plant at 30 cents per 2,000 pounds. The cement was Josson's Portland, and cost at plant $2.21 per barrel. The water is fresh and derived from same source as for gun battery.

The drainage is complete over portion excavated, consisting of a 10-inch main drain, with 6-inch drains to pits and 3-inch drains around outside of masonry.

A conduit for electric-firing wires was laid in the floor.

The outlay for the year was as follows:

Concrete (528⅔ cubic yards)	$9,028.69
Excavation (10,781 cubic yards)	3,819.10
Drainage	1,174.98
Electric-wire conduit	321.75
Incidentals	4,125.59
Total	18,470.11

Allowing excavation its share of incidentals, $714.17, the cost of 10,781 cubic yards is $4,533.27, or 42 cents per cubic yard.

APPENDIX No. 3.

MINING CASEMATE, SAN FRANCISCO HARBOR, CALIFORNIA.

REPORT OF LIEUT. COL. WILLIAM H. H. BENYAURD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., July 13, 1893.

GENERAL: I have the honor to render reports, in duplicate, upon the works for harbor defense under my charge for the fiscal year ending June 30, 1893.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

MINING CASEMATE, SAN FRANCISCO HARBOR.

Under date of October 18 last, I was instructed to prepare plans, with detailed estimates, for the construction of a mining casemate. The plans were duly submitted and approved, and an allotment of $7,590 was made from the appropriation of February 24, 1891, for the proposed work. The location selected is in a cove. The bank is bluff and rocky, with little beach in front at low tide and none at high tide. In order to reduce the cost to a minimum the plan contemplated only sufficient excavation in the rocky bank for the body of the casemate, with a retaining wall at a sufficient distance in front to support the slope of the earthen cover.

Work was begun toward the end of January. At first the men were employed alternatively at this and the emplacement, according as the tide would render operations at the casemate impracticable.

In order to gain ground to work upon, a bulkhead was first put in and filled in with excavated material to the height of the bottom of the casemate. The outside planking of the bulkhead was used as the inner form of the retaining wall. The outside form for the wall, with its proper batter, was then put in and secured to the bulkhead. After removing the beach gravel to rock inside the framework the concrete wall was built to the top of the bulkhead and the cable gallery put in. The excavation was continued and carried on until there was sufficient

room for the body of the casemate to rest entirely on natural ground. This work was completed about the end of February. The concrete for the casemate proper was then begun and carried on with some little delay, owing to rain and other causes, and was completed in May. The outside of the structure was covered with a coating of asphalt and coal tar boiled. Before commencing the final filling, 3-inch open drain tiles were put in around the structure and covered with gravel. The filling was then begun from the bank above and carried to completion. Over this fill a foot of loam was placed and all covered with manure and sown with grass seed. The inside was plastered and a coat of hard paint put on. A surface drain was cut on the hillside above to prevent wash. A permanent supply of water was procured by damming up a spring about 1,500 feet distant and laying a pipe therefrom to the casemate.

The cost of the work was as follows:

Clearing site	$182.00
Excavation, 865 cubic yards, at 73½ cents	635.78
Fill, 1,610 cubic yards, at 33½ cents	536.67
Concrete, 405 cubic yards, at $6.06	2,454.30
Bulkhead	337.61
Centering (lumber and carpenter work)	365.22
General blacksmithing	556.88
Watchman (three months)	180.00
Miscellaneous expenses	61.4.50
Boat service	339.75
Plaster and hard finishing, 1,673 square feet, at 12½ cents	206.34
Asphalt covering, 87 square yards, at 42½ cents	36.98
Drainage and ventilation	125.53
Loam and manure, 110 square yards, at $2.77	304.70
Water supply	337.86
Tools	70.70
Total	7,284.82

With the balance it is intended to put in the doors and steps, and after the ground is thoroughly settled to put in a surface drain on top of the work.

The cost of excavation was increased somewhat by reason of this work having to be repeated several times owing to slides in the steep bank caused by heavy rains.

Money statement.

Torpedoes for harbor defense, act of February 24, 1891.

Amount allotted by Department letter of November 30, 1893	$7,590.
Amount expended during the fiscal year	7,284.
Balance unexpended at the end of the year	305.

APPENDIX No. 4.

PROTECTION OF SITE OF FORT NIAGARA, N. Y.

REPORT OF CAPT. DAN C. KINGMAN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

UNITED STATES ENGINEER OFFICE,
Oswego, N. Y., July 10, 1893.

GENERAL: I have the honor to transmit herewith annual report for the fiscal year ending June 30, 1893, for the following work in my charge:

Protection of the site of Fort Niagara, N. Y.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

PROTECTION OF THE SITE OF FORT NIAGARA, N. Y.

Operations have been in progress for the protection of the site of Fort Niagara, N. Y., under an allotment from the appropriations for "sea walls and embankments" and "preservation and repair of fortifications." The project for this work was approved November, 1888, and is briefly as follows:

First. To build a dike of stakes and fascines, paved on the top with stone, and held at a reference 2.0 feet, Lake Ontario gauge, from the northwest bastion of Fort Niagara to the northerly angle of the wharf, and to demolish the wall that makes the western front of the fort and use its material as a riprap and filling behind the dike.

Second. To build a similar dike from the southern end of the lighthouse reservation towards the southern end of the military reservation of Fort Niagara, as far as the means available will permit, and to fill in behind the dike, a bank of low slope to a reference 6.0, Lake Ontario gauge; to grade the bank above to a slope of 1 on 2 down from the general level of the parade, leaving between the two slopes such a roadway as may be desirable for the use of the post; to plant the lower slope with willows and the upper one with grass. Subsequently, this

project was modified by substituting iron pipes for the wooden stakes used to secure the fascines. This change increased the durability of the work, but it also increased its cost nearly 50 per cent. The project was extended to include the repair of the retaining wall at the northwest angle of the fort, and all other necessary repairs to the same along the lake front.

The amount expended under this project to June 30, 1893, is $29,717.13, and has resulted in the rebuilding of a portion of the retaining wall 40 feet long and 39½ feet high, bonded into the old work, and in the repair of numerous breaks in the face of the wall along the lake front (over 50 cubic yards of dimension stone being used for the latter purpose), in a pretty general pointing of this wall, and in the construction of a concrete breakwater 70 feet long to protect the exposed northwest angle. It has also resulted in the construction of 770 feet of dike work along the lake front and 941 feet along the river front—1,711 feet in all—and in the filling in and grading behind 941 feet along the river front according to the project, and in planting the graded slope with sod.

OPERATIONS.

No allotment has been made for this work since that of October 11, 1890, and the balance available at the beginning of the year was too small to permit any new work to be undertaken. All that could be done, therefore, was to endeavor to protect the work already accomplished. With this object in view the graded slope was redressed, and the gullies that had formed were filled up, and an effort was made to cover it with grass by planting tufts of sod upon it, as is done on the levees in the South. Thick pieces of good live sod about 6 inches square were planted about 3 feet apart all over the slope. The sod has all taken, but it has not yet spread enough to cover all the surface of the ground. The slope was washed and gullied somewhat during the past spring. This was due to the surface water from the plain above running down over it after heavy rains. To prevent this in the future a trench will be formed along the crest of the bank, in which a line of porous tile will be laid, and the trench then filled with broken stone. This tile will be connected at proper points with lines of glazed tile buried in the slope, which will conduct the water down to the river. This work will be done this summer with the funds now on hand.

The bank along the river above the protected portion is still caving. It would be a valuable improvement if protection could be continued without delay according to the project.

To enable repairs to be made to the base of the wall along the lake front in the fall of 1891, a movable crib in the form of a very strong scow was built, to be sunk as required and used as a platform. This crib was found to be still sound and in good condition, and capable, with some slight alterations, of being made into a small barge suitable for general use. It has been taken to Charlotte, where a good many barges are needed in connection with the work now in progress, and will be repaired from the appropriation for that work, and used as long as it may be required. It will be taken up and accounted for as a barge on the property return for Fort Niagara.

REMARKS.

No other work than that of protecting the slope can be undertaken with the funds now available. The sea wall is now in good condition

for work of this kind. It was never anything more than coursed rubble of rather soft stone. The bank protection might be extended up the river to good advantage.

In pursuance of the project of November, 1888, some 154 linear feet of the detached wall that forms the western front of the work was torn down and the stone used to fill in behind the dike. This was done during the first season's work.

It makes a very conspicuous and unsightly breach and leaves the work entirely open and easy of entrance on this side.

There is plenty of other stone available for filling behind the dike, and I would recommend that this wall be restored. The cost would not exceed $3,000; $10,000 in addition, if that sum were available, could be advantageously applied to the continuation of the work of protecting the site during the fiscal year ending June 30, 1895.

Money statement.

July 1, 1892, balance unexpended	$550.62
June 30, 1893, amount expended during fiscal year	267.75
July 1, 1893, balance unexpended	282.87
Amount (estimated) required for completion of existing project	26,105.30
Amount that can be profitably expended in fiscal year ending June 30, 1895	13,000.00

APPENDIX No. 5.

SEA WALL AND EMBANKMENT AT DAVIDS ISLAND, NEW YORK HARBOR, SEA WALL AT GOVERNORS ISLAND, NEW YORK HARBOR.

REPORT OF LIEUT. COL. H. M. ROBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

IMPROVEMENTS.

a. Sea wall at Davids Island, New York, Harbor.

b. Sea wall at Governors Island, New York Harbor.

ENGINEER OFFICE, U. S. ARMY,
New York, July 10, 1893.

GENERAL: I have the honor to transmit herewith * * * for the fiscal year ending June 30, 1893, annual reports upon sea walls at Davids and Governors islands, New York.

* * * * * * *

Very respectfully, your obedient servant,

H. M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

5 A.

SEA WALL AND EMBANKMENT AT DAVIDS ISLAND, NEW YORK HARBOR.

This island, which is occupied by the recruiting service of the Army, lies at the head of Long Island Sound, about opposite New Rochelle, and is 21 miles distant by water from the Battery, New York City.

In 1883, upon recommendation of the depot surgeon, an estimate for a sea wall was transmitted to Congress, papers concerning which were printed in House Ex. Doc. No. 205, Forty-eighth Congress, second session. The recommendation was renewed in 1884.

The object first stated was to prevent the collection of garbage and refuse matter upon the shores; the second recommendation stated as an additional and important object, the preservation of a fresh-water

pond from overflow by the sea at high tides. The pond was separated from the sound by a narrow beach, which was not high enough to prevent waves breaking over. This pond, formerly used as a water supply, is now chiefly used for obtaining ice. An additional object of the sea wall is the reclamation of about 2 acres of low marshy land, which the embankment was intended to fill up.

In 1886 a revised estimate of cost was presented, as follows:

1,000 linear feet of wall, at $35 per foot	$35,000
40,000 cubic yards of earth embankment, at 30 cents per cubic yard	12,000
Total	47,000

The plan then was to build the wall of masonry and carry it 12 feet above mean low-water level. The mean rise of tide is 7.3 feet.

Under the appropriation for sea walls and embankments, made by act of Congress, approved September 22, 1888, an allotment of $47,000 was made for the above work. The plan of construction of sea wall was modified to one for a riprap wall of outer slope 1 on 2, inner slope 1 on 1, to be built to 10 feet above low water and capped with a course of dimension stone 2 feet thick and 6 feet wide. The originally designed vertical masonry wall was intended to prevent the lodgment of garbage, etc., but the stringent regulations concerning the disposal of such matter now being enforced in the harbor of New York and adjacent waters, will prevent any nuisances of that kind; and the riprap wall was considered equally efficient for every other purpose and more economical. The sea wall was completed in April, 1890. A survey of the island in connection with desired sea walls was made in June, 1891. The map of this survey was made and transmitted to the Chief of Engineers with final report, dated May 20, 1892.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

No work upon the sea wall has been done.

PRESENT CONDITION OF IMPROVEMENT.

The sea wall is 954 feet long and contains 9,068 tons of riprap and 953.7 linear feet of capping stones 2 feet thick and 6 feet long, stretching across the wall; its height is 12 feet above mean low water about 4¾ feet above mean high water. The wall is in good condition; it has settled slightly in places, owing to the softness of the foundation on which it rests, but not enough to need repair.

The embankment contains 31,836 cubic yards of filling.

The embankment close to the wall has been cut out to depths of from one-half foot to 1½ feet in places by seas breaking over the wall at extreme high tides. It will require about 1,000 cubic yards of filling to repair the bank.

PROPOSED OPERATIONS.

Nothing further is contemplated except to repair the damage to the embankment above described, and such other slight repairs as may from time to time be needed.

The report on the survey referred to mentions a wall on the west side of the island north of the coal wharf as necessary to check the continuing erosion of the shore; the estimated cost of this wall and of embankment behind it is $30,000.

Money statement.

July 1, 1892, balance unexpended	$5,000.00
Amount transferred to allotment for sea wall at Governors Island, New York	4,000.00
July 1, 1893, balance unexpended	1,000.00
Amount (estimated) required for completion of existing project	55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895.	30,000.00

5 B.

SEA WALLS ON GOVERNORS ISLAND, NEW YORK HARBOR.

The shores of this island were frequently covered with offal and garbage, which, drifting up at high water and decaying in the sun as the tide fell, were (in summer) a source of constant danger to the health of the garrison.

In 1865 a project was adopted providing for inclosing the entire island by a masonry wall, to be built at or near low-water line, in order to prevent the lodging of such refuse matter.

Under an allotment made in 1865, 700 linear feet of masonry wall was built on the southwest side of the island in 1866, and under other smaller allotments 399 linear feet, as reported, was built. This was subsequently extended as a temporary dry wall nearly along high-water line to Castle Williams, covering the entire southwest side of the island.

By act approved August 7, 1882, $39,000 was appropriated for "completing a sea wall already commenced on the southwest side of Governors Island, New York Harbor, and constructing a sea wall on its southeastern portion." Under this appropriation and one of $15,000 made in the sundry civil bill approved March 3, 1883, the wall was extended 206 feet along the south side of the island and 1,502½ feet along the east side of the coal wharves. In 1884 an allotment of $500 was made for completing the filling and grading behind the east wall, left unfinished on account of the exhaustion of funds.

Under act of Congress, approved September 22, 1888, making appropriation for sea walls and embankments, $50,000 was alloted to this work and applied to construction of a wall 1,099 feet long, extending eastwardly from Castle Williams wall and connecting it with the ordnance wall.

The act making appropriation for preservation and repair of fortifications, approved August 18, 1890, included an appropriation of $50,000 "for completing sea wall on Governors Island, New York Harbor." A wall was built on the west side of the island extending southwardly from the Castle Williams wall, a distance of 1,499 feet, and connecting it with the wall around the south side of the island. This was finished in March, 1892, and up to July 1, 1892, the entire island was inclosed by sea walls, except the short distance between the coal dock and the permanent stone wharf.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the beginning of the year a contract was in force for constructing about 212 linear feet of wall, extending north from the north end of the east wall, passing under the coal dock and main landing, with return

to the westward. Work under this contract was begun early in July and completed November 5, 1892, the total length of wall built being 297.5 feet.

After advertising, by circular letter, proposals were received for building a sea wall to connect the one last built with the shore end of the stone wharf, replacing an old timber bulkhead. With approval of the Chief of Engineers, dated September 13, 1892, the lowest bid, that of I. H. Hathaway & Co., of Philadelphia, Pa., to do the work at the rate of $17.75 per linear foot, was accepted. Work was begun October 25, 1892, and completed December 17, 1892, the total length of wall built being 99.85 feet.

Under public notice circular in January, 1893, 249 cubic yards of riprap, at $1.50 per yard, delivered in place, was purchased and used to protect the foundation of the wall on the north side of the island at its most exposed point.

In March and April 345 cubic yards of earth was purchased, under public notice, at 37 cents per yard, and applied to filling and grading the area behind the sea walls on the east side of the island.

By approval of the Chief of Engineers, dated March 16, 1893, $4,000 of the balance of allotment for Davids Island (from appropriation for sea walls, 1888) was transferred to sea walls on Governors Island, to admit of re-pointing, protecting the foundation, additional filling and grading, and removing the old landing near Castle Williams. Under public notice circular, proposals for these several works were received April 12, and the following were accepted:

1. For riprap delivered around the foundation, as required, about 850 cubic yards, at $1.40.

2. For pointing the sea walls, using mortar of Portland cement and sand, equal parts; per barrel of cement used, $10.

3. For broken stone, graded and rolled into the embankment back of the sea walls, per cubic yard, $2.50.

4. For re-grading and sodding part of the embankment back of the north sea wall, about 4,000 square feet, $350.

The lowest bid received for removing the old landing was $800; it was higher than was expected, and as it was believed that the landing could be repaired so as to be available for use for that amount, the bids were rejected, with the approval of the Chief of Engineers, dated April 14, 1893, and June 2 proposals for repairs to the landing were received and the lowest bid was accepted.

Up to the close of the fiscal year under the first of these offers 685.3 cubic yards of riprap had been placed around the foundation of the walls and work was in progress. Under the second offer 45 barrels of cement had been used in pointing about 759 linear feet of wall and work was still in progress. Under the third offer work had not been begun.

Under the fourth offer the sodding and grading were completed June 21, 1893.

Work of repairing the old landing was about to be commenced.

PRESENT CONDITION OF THE SEA WALLS AROUND THE ENTIRE ISLAND.

The entire island is now inclosed by stone sea walls; the completion of the repairs now in progress will leave them all in good condition.

Additional riprap protection and pointing may be needed from time to time, but nothing is required for the ensuing year.

PROPOSED OPERATIONS.

With the available funds the foundations of the sea walls will be sufficiently protected, the masonry will be re-pointed where necessary, and the embankments will be repaired and put in order.

No other work is now needed in this connection and no additional funds are asked for.

Money statement.

July 1, 1892, balance unexpended		$13,854.14
Transferred from allotment for sea wall at Davids Island, New York		4,000.00
		17,854.14
June 30, 1893, amount expended during fiscal year		11,222.15
July 1, 1893, balance unexpended		6,631.99
July 1, 1893, outstanding liabilities	$1,789.00	
July 1, 1893, amount covered by uncompleted contracts	3,434.00	
		5,223.00
July 1, 1893, balance available		1,408.99

APPENDIX No. 6.

WATER SUPPLY AND SEWERAGE SYSTEM AT FORT MONROE, VA.

REPORT OF MAJ. CHARLES E. L. B. DAVIS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR FISCAL YEAR ENDING JUNE 30, 1893.

IMPROVEMENTS.

a Water supply at Fort Monroe, Va. | *b* Sewerage system at Fort Monroe, Va.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 10, 1893.

GENERAL: I have the honor to forward herewith my annual report for the year ending June 30, 1893, on fortifications in my charge.

Very respectfully, your obedient servant.

CHAS. E. L. B. DAVIS,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

6 A.

WATER SUPPLY.

The question of an improved water supply at Fort Monroe has long been agitated. At present the only potable water to be obtained upon the reservation is rain water stored in cisterns. This is a somewhat unsatisfactory source, as it is liable to fail during a very dry season, and, owing to the lack of a proper system of sewerage, there is also the danger of contamination of the water so stored. The importance of an abundant supply of pure water for the use of the garrison, the large force of United States employés, and citizens who visit the post can not be overestimated. From a military point of view it is hardly necessary to say that it is of vital importance that an adequate supply of good water, not liable to be cut off during the time of war, should be had within the limits of the fortification. Such a supply, it has been thought, might be obtained by sinking an artesian well inside the fort.

PRESENT ARRANGEMENT.

The supply of rain water is at present supplemented by water obtained from driven wells on the west side of Mill Creek and carried to the reservation in iron pipes. This water is of inferior quality and is not regarded as fit for drinking purposes. A personal examination was made of this water supply in February, 1893. A steam Dean pump pumps water from driven wells, there being 48 2-inch points sunk to obtain water at a depth of from 10 to 12 feet below the surface and connected with a main pipe 8 inches in diameter. During the long continued drought of 1892—a drought of unusual duration—there were pumped 25,000 gallons per day, which, estimating the military population at 863, was 30 gallons per capita. According to standard authorities, Louisville consumes 24 gallons per capita, Boston 60, Chicago 84, and Washington 138. By economizing, therefore, the supply sufficed, though by putting in a duplicate and larger pump and increasing the number of well points, an ample supply can always be obtained. It is understood that the Quartermaster's Department intends increasing the plant as above indicated. The water, when first drawn from the pump on the day of my inspection, was somewhat turbid, the turbidity being due to a large quantity of minute bubbles of air or gas which quickly rose to the surface, leaving the water quite clear. The water had no unpleasant taste and was apparently potable, but the surroundings are not above suspicion, as there is cultivated land in the vicinity and the seepage from fertilizers and manures must tend to impregnate the water. The water is said to be hard and at times much discolored, but can be used for bath and laundry purposes, but not for drinking or cooking, for which only the rain or cistern water is used.

Congress, by the act of February 24, 1891, made an appropriation of $6,000 for the purpose of sinking an artesian well. As this amount is not sufficient to cover the cost of sinking a well beyond a depth already demonstrated to be insufficient, no work has been done, but the subject has been studied during the fiscal year and information bearing upon it obtained.

The following is a summary of the attempts made in former years to sink an artesian well.

PREVIOUS OPERATIONS.

The first effort to obtain water by an artesian well at Fort Monroe was made in 1846, when the original well was commenced. There were 225 feet of 8-inch pipe sunk, and inside of this 283 feet of 5-inch pipe. No record of the exact depth reached has been found. This well was abandoned in 1851.

In 1864–'65 Gen. B. F. Butler put down 340 feet of 12-inch pipe.

In 1867 Col. Henry Brewerton commenced sinking an 8-inch pipe within the 12-inch pipe of the well of 1864–'65, and a part of the 5-inch and 8-inch pipe of the well of 1845 was withdrawn and used in this work. On June 30, 1868, a depth of 370 feet had been reached. The sinking of the 8-inch pipe was continued until a depth of 517 feet below the surface of the parade of the fort was reached, when the lowest section of the pipe separated from the rest. It was found that a pipe 5½ inches in exterior diameter could pass through the disjointed pipe, and it was decided to insert within the 8-inch cast-iron pipes wrought-iron tubes of 4½ inches interior diameter, with screw ends, and 585 feet of this tubing was successfully inserted. At a depth of

585 feet the bottom of the clay stratum, through which the auger had been passing, was reached, and a stratum composed of about 90 per cent of sand and 10 per cent of clay was reached. After passing into the sand a water-bearing stratum was reached, which yielded a limited amount of saline water, which, when left undisturbed for twenty-four hours, rose in the tubing to a height of 4 feet 6 inches above the level of the parade of the fort. On June 30, 1870, the well had been sunk 900 feet, and the 4½-inch tubing sunk 886 feet below the parade. Work was suspended in August, 1870, at which date the 4½-inch tubing had been forced down to a depth of 898 feet below the parade, while the auger had penetrated to a depth of 906.5 feet below the same level. In November, 1871, operations were resumed, and a drill was substituted for the auger previously used. The 4½-inch tubing, which had been left projecting about 15 feet above the ground, was found to be full of water. The tube was tapped near the ground, and, on being plugged, the pipe was found to fill gradually. On pumping out the water to secure a dry tube for drilling, a sudden inrush of clay, coarse gravel, and shell filled the tube for about 120 feet from the bottom. After removing this with the sand pump and attempting to drill, it was found that the lower section of the tubing was entirely detached. A passage for the drill was then cut through this section, but another influx of material moved the section, and but little progress could be made. The removal of the 4½-inch tubing was then commenced, and, on June 30, 1872, 664 feet had been taken out. Operations were soon after suspended for want of funds, and have not since been resumed.

INFORMATION COLLECTED DURING FISCAL YEAR.

Books relating to the subject of artesian wells were consulted and correspondence solicited from a number of persons.

There are a number of artesian wells at Milwaukee, Wis., sunk by the large brewing establishments, though the water is not used in the manufacture of beer, as it is too hard and not suited for the purpose, and I believe it is not used in the steam boilers, but is used for washing barrels and bottles and in case of fire. The contractors, familiar with the work, have generally contracted to furnish a flowing well of a definite capacity, as 200 or 250 gallons per minute at a cost of $2.20 per running foot in one case, and in another 600,000 gallons per day at $4 per foot. The latter well, sunk on the site of the Loan and Trust Building, is 1,730 feet deep and extends into the Potsdam formation. The water was piped across the street into one of the principal hotels and was used in the rooms; the water was very hard and experience showed it incrusted the hot-water pipes so that its use had to be discontinued except for the cold-water supply. The contractors, learning of the inquiries set on foot and desirous of making an offer for the proposed work at Fort Monroe, wrote for information as to the character of the formation, depth, etc.; information which could not be furnished, as it is unknown.

West Point, on the York River, about 45 miles from Fort Monroe in a direct line, was reported to have many artesian wells giving water satisfactory in quality and quantity, and correspondence confirmed the fact and elicited the reply that "The quality of the water is soft and is admirable for cooking, laundry work, and drinking, and is used with great success for steam in stationary boilers." The wells are from 150 to 165 feet in depth and cost on an average about $40 each. They are simply driven wells and hardly come under the designation of artesian.

The analysis shows sodium carbonates and sulphates in sufficient quantities to render the water hard, though it is claimed not to be so.

Near the quartermaster's pumping plant on Mill Creek, there is a tract of some 40 acres of land purchased by the Hampton Water Supply Company, about four or five years ago, to furnish water to Hampton, the Soldiers' Home, etc. Driven wells were first sunk similar to those of the Quartermaster's Department, but by pumping night and day, under the impression that the supply was inexhaustible, the water became brackish and unfit for use. There is a stratum of gravel about 18 feet below the surface, 18 inches to 2 feet thick, lying on top of marl, and it may be the salt water of Mill Creek was drawn through this stratum. A contract was next made with Baltimore parties to bore an artesian well which, as near as can be learned, was sunk to a depth of about 1,000 feet and the well abandoned, no water apparently having been obtained. The exploiters of the project are very reticent and no information can be obtained from them. The abandoned well, with derrick, boiler, engine, and portions of the plant are still standing.

Inquiry about the artesian wells at the Norfolk navy-yard resulted in finding out that these wells are not artesian, but simply driven wells; the water is very hard.

The most interesting information collected was that relating to the artesian well at Lamberts Point. This was obtained for me through the kindness of Lieut. Edward Burr, Corps of Engineers, stationed at Norfolk, Va. Copies of the letter of Mr. N. M. Osborne, the general agent of the Norfolk and Western Railroad Company, addressed to Lieut. Burr, and of the analysis of the water are given below.

NORFOLK AND WESTERN RAILROAD COMPANY,
Norfolk, Va., July 21, 1892.

DEAR SIR: In reply to yours of the 5th instant, I beg to say that the "artesian" well constructed by this company in 1890–'91 at Lamberts Point, was sunk by Mr. A. L. Miller, of Pulaski, Va. This well is situated about 250 feet from the shore end of the company's coal pier No. 1, or N. 87° E., approximately 3,000 feet from Lamberts Point Light. The well is in all 610 feet deep, through earth for its entire depth. There were used two lines of "Extra Heavy" wrought-iron tubing connected with inserted screw joints, flush inside and out. The first size used was 8 inches inside diameter for a depth of 402 feet, but on account of the failure of the casing at a joint by telescoping, it was deemed unadvisable to push it further, and accordingly a line of 7-inch was put down through the 8-inch and this size was continued to a depth of 598 feet. When the casing reached this depth, the drilling tool worked ahead of it, encountered the water-bearing stratum, and it was not thought necessary to push it any further. When the flow of water first started, quite a large quantity of sand came with it, and in the course of a few days the sand had risen 20 feet approximately above the bottom of the casing and the flow of water was almost entirely cut off. About ten days were consumed in clearing the sand out of the well so that the original flow of water could get out. The day's work would sometimes amount to about a cubic yard and would free the casing of sand, but on going to work the following morning the sand would be found as high as ever in the pipe. At the end of ten days, however, the sand ceased to rise in the pipe, since which time the normal flow has been about 70 gallons per minute, except that at periods of from twelve to twenty-four hours the flow increased very greatly and sometimes quantities of sand would come up with the water. At other times the water would be quite muddy, with a disagreeable odor similar to that from excavations in swampy land, due no doubt to decayed vegetable matter. There seemed to be no solid matter in the water whatever. The water is quite clear, having a slightly sweetish taste, and has a temperature of 69° F. at the surface, which is approximately 11 feet above mean low water. We ascertained that the water would rise to a height of 18 feet above the surface of the ground; at this height the flow ceased entirely, but when the casing was again cut off the well resumed its normal flow.

The total cost of the well, exclusive of the basin, was $5,469.08. I inclose you a copy of our contract with Mr. Miller.

After we had found out by analysis, and, indeed by practical trial, that the water was not fit for the use of our engines, we thought of sinking another well at a dif-

ferent point, and we asked propositions from Mr. Miller for another well, and his proposition was much higher than the contract inclosed, but our engineer, Mr. Bonner, who paid particular attention at the time this well was being sunk, does not think there will be any difficulty in contracting with responsible parties for such a well as we have at Lamberts Point at the price paid Mr. Miller.

There was no special difficulty in the work; so long as the casing was kept moving there was no difficulty with that, but we found that if the work was allowed to stop for any length of time, as over night, or over Sunday, two nights, the sand and earth became so packed around the pipe that great trouble was experienced in getting started again; we therefore think it would be economical to work continuously.

When the 8-inch casing had gone down about 150 feet it was found that a jet of water put down through a 2-inch pipe so loosened up the earth that the casing moved almost with its own weight. Afterwards the water jet was used almost entirely for sinking the casing, and for the excavation. For this water jet there was used a Gordon & Maxwell duplex pump delivering about 80 gallons of water per minute, under a pressure of 100 pounds delivered through a 2-inch iron pipe. Both Mr. Bonner and Mr. Miller are of the opinion that if the water jet had been used in the beginning on the outside of the 8-inch casing, that we would have been able to have sunk the casing much further, and perhaps even to the entire depth.

I attach a copy of the analysis of the water, made at the Shepard Laboratory, Charleston, S. C., April, 1891.

In regard to the contract, the items specifying the prices paid was construed as follows. For earth or granite for the first 300 feet, $6.50; for the second, $7.50, etc. We have samples of the material taken from each stratum as it was passed through, and I think an examination of these samples will give you a better idea of the materials passed through than if I should attempt to describe them.

I will be very glad at any time that may suit your convenience, if you will let me know when you will go to Lamberts Point, to have Messrs. Keen and Bonner, engineers, accompany you and give you any information in regard to this well that they can furnish.

I will be glad, too, if at your convenience you call at my office, and I will show you samples of the materials encountered in sinking this well.

Yours truly,

N. M. OSBORNE,
General Agent.

EDWARD BURR, Esq.,
Lieutenant Engineers, etc., Norfolk, Va.

SHEPARD LABORATORY,
Charleston, S. C., April 28, 1891.

DEAR SIR: The results obtained in the sanitary examination of the water from your Norfolk well are as follows:

The water contains—

	Parts per million.
Free ammonia	0.48
Albuminoid ammonia	0.1075
Oxygen consumed	0.08

The amounts of free and albuminoid ammonia present in the water, considered together, would condemn its use for drinking purposes were it not for the depth of the well—over 600 feet. But this depth renders it almost certain that the water may be used with no deleterious effects, a view which is confirmed by the very small amount of oxygen consumed by it (Wood & DeChaumont's process). For bathing the water will answer admirably. For cooking and washing it will probably prove unsatisfactory on account of the discoloring action of the carbonate of soda on starch compounds.

In reply to yours of the 14th ultimo we would state that we still think you will find the water unsuitable for locomotive purposes, and that we are confirmed in this view by the experience derived from a number of wells, of greater or less depth, that have been drunk in this neighborhood by the various phosphate companies. If you will refer to our letter of the 11th, you will see that we stated that our well was used in stationary boiler, but that it was necessary to take certain precautions (in regard to connections, cocks, etc.) to avoid annoyance. All of the wells of which we have any knowledge, and which have a more or less similar composition, though with varying amounts of solids, are liable to this trouble, which, however, can be guarded against.

If you decide to use this well, we would advise you to have the sanitary examination repeated in the course of, say three or four months.

Yours very truly,

SHEPARD LABORATORY.

CHAS. S. CHURCHILL, Esq.,
Engineer Maintenance of Way, Norfolk and Western R. R. Co., Roanoke, Va.

Analysis of water from Lamberts Point artesian well, giving solid residue in grains per United States gallons of 58,400 grains.

	Grains.
Insoluble matter	0.583
Oxide of iron	0.053
Lime	0.408
Magnesia	0.169
Soda	32.646
Potash	1.446
Sulphuric acid	2.105
Chlorine	20.510
Carbonic acid	10.544
Water of crystallization	0.012
	68.48
Less oxygen equivalent of chlorine	4.62
	63.86

Subjoined is a copy of a letter of recent date from Prof. W. J. McGee, of the U. S. Geological Survey, who has shown much interest in the proposed well:

U. S. GEOLOGICAL SURVEY,
Washington, D. C., April 15, 1895.

DEAR SIR: Your communication of the 12th instant, inclosing memorandum of a conversation between Mr. J. B. Duncklee and myself, is at hand. The memorandum is satisfactory and you are authorized to publish or make any other use of it you may see fit, with perhaps the alteration of a single word—the substitution of the word "might" for "would," as indicated, in the first paragraph.

Recent borings in eastern Maryland indicate that, in some cases at least, water derived from the greensand is sufficiently pure for ordinary purposes, and is indeed commonly regarded as excellent. This comparative purity is of course due to the general fact that the greensand is deeply covered, and is thereby prevented from ready oxidation, combined with favorable local conditions; in consequence of which the subterranean circulation of air and water is so limited as to retard chemic action. But it is always better to seek a water supply in a chemically stable deposit, such as the Potomac formation.

I am glad to receive your information concerning the artesian well at Lamberts Point, which would seem from the limited depth, and from the character of the water, to obtain its supply from the Tertiary deposits; the presence of ammonia suggesting the influence of greensands. It is my judgment that an equally abundant and purer supply would be found there, as at Fort Monroe, at a greater depth, our estimate being about 1,200 feet.

I may add that the presence of ammonia in the Lamberts Point water suggests another possibility, into which it might be well to inquire, and against which it will certainly be desirable for you to guard, in case you bore at Fort Monroe, *i. e.*, surface contamination. The surface deposits about both places are, as you know, saturated with ground water to within a few feet of the surface, and this ground water is contaminated from stables, cess pools, shambles, and perhaps cemeteries, so that its use is a menace to heath. Now, it is a difficult matter to case out this ground water, particularly when the artesian head is not strong, and in some cases of which I have known the supply supposed to come from deep lying strata was really superficial, and due to leakage in the casing used in the upper portion of the well.

The memorandum referred to above is returned herein. Permit me to assure you that it will be a pleasure to serve you in any way in the proposed boring.

Yours respectfully,

W. J. MCGEE.

Mr. CHAS. E. L. B. DAVIS,
Corps of Engineers, U. S. A., 601 Eighteenth Street, City.

ANDUM OF A CONVERSATION WITH PROF. W. McGEE, OF THE GEOLOGICAL SUR-Y, IN REGARD TO THE ARTESIAN WELL AT FORT MONROE, JUNE 28, 1892.

McGee said that the coastal plain lying between the mountains and the sea Atlantic coast had essentially the same geological formation from Sandy o Florida; that the strata dip toward the sea, and that at the outcrop of the overlying the rock the conditions are favorable for the catchment of water. mations are Tertiary and Cretaceous, and from a geological point of view there ason why artesian water should not be found near the coast and at Fort Mon-Wells have been successfully sunk in New Jersey at depths of from 300 to 900 Charleston to about 2,000 feet, and at St. Augustine to about 1,200 feet. lications are that artesian water may be found at Fort Monroe at a depth of ,200 feet. It will probably be found in the Potomac formation, consisting of sand, etc., which overlies the rock and outcrop at Washington, D. C., and at nd, Va. The probabilities are that strata above this level contain greensand, d *might* furnish an impure water. While this is the probable depth, no *cer-*diction of depth can be made, as there may be local conditions at Fort Mon-hich we have no knowledge which may modify the result.

the size of the well, Prof. McGee suggested that any error should be on the the largest size of the well. A 12-inch well at first was suggested, gradually hing toward the lower end, which should be large enough to furnish the de-uantity of water.

ring to the experience with the old well at Fort Monroe, Prof. McGee sug-that when the new well was sunk a site be selected, say, 100 yards or so from site, in order to avoid any local conditions in the water-bearing strata which ve interfered with the success of the old well.

well is sunk the Geological Survey will probably detail a geologist to take ns, or, at least, will give us full directions as to the best method of taking serving them.

following estimates of cost at various depths are based upon the ct figures for the Lamberts Point well, the price per running foot for earth or gravel:

Depth.	Price per running foot.	Cost.	Total depth.	Total cost.
Feet.			*Feet.*	
300	$6.50	$1,950	300	$1,950
300	7.50	2,250	600	4,200
400	8.50	3,400	1,000	7,600
500	9.50	4,750	1,500	12,350
700	11.00	7,700	2,200	20,050

ater is met with at 1,200 feet, as in the opinion of Prof. Mc-is reasonable to expect, the well would cost at the above figures , but if the Government undertakes to sink an artesian well at Monroe enough money ought to be appropriated to go at least eet before abandoning the attempt, and for that purpose it is nended that $14,000 be appropriated in addition to the $6,000 id, making $20,000 in all. The Quartermaster General, Gen. M. gs, in a letter addressed to the Secretary of War, dated June 4, dvised that no commencement be made with anything less than ove sum.

Money statement.

1892, balance unexpended	$6,000.00
1893, balance unexpended	6,000.00
(estimated) required for completion of existing project	20,000.00
that can be profitably expended in fiscal year ending June 30, 1895	20,000.00

6 B.

SEWERAGE SYSTEM.

The sewerage system of Fort Monroe is seriously defective. It drains only the buildings within the walls of the fort, while for the drainage of the quarters outside there is no provision whatever. The sewers have not sufficient inclination to make them self-cleansing and are often obstructed. The main sewer alone is flushed by tidal water impounded in the moat and discharges the sewage into Mill Creek, where it is often washed up along the shore and becomes a nuisance. As a result of the existing conditions the health of the garrison suffers and numerous cases of typhoid fever are reported—a disease formerly unknown at the post.

On July 28, 1888, Lieut. Col. P. C. Hains made a report upon the existing sewerage system—which he stated to be defective—and submitted a plan for a new system for draining the fort alone, the sewerage to be pumped into Chesapeake Bay. The estimated cost of this system was $33,000.

On March 2, 1889, Congress made an appropriation of $25,000 "for the construction, complete, of a sewerage system."

Specifications for a complete system were prepared and proposals invited by public advertisement. The lowest bid received was $35,749.48, but this did not conform to the specifications. As all the bids exceeded the appropriation made by Congress they were rejected.

The question of the drainage of the quarters and buildings outside the fort, and also of the several hotels authorized to be built by acts of Congress, has since been the subject of consideration. Various plans and projects looking either to the construction of a combined system providing for the drainage of all these buildings or of two separate systems, one for the hotels and one for the quarters, have received attention. In the event of the construction of a combined system, the manner in which the cost of such a system should be met by the several interests involved has likewise been considered. On October 29, 1891, the Secretary of War decided that two separate systems should be constructed, one by the United States and the other by the hotel proprietors and others who enjoy the privilege of residence on the reservation. The existing appropriation of $25,000 would only be sufficient, it was found, for draining the fort proper and discharging the sewage into Mill Creek or Hampton Bay, and would not provide for the drainage of the quarters outside the fort. Such a system would be unsatisfactory and incomplete. Estimates were therefore prepared for a system to drain both the quarters and public buildings within and those without the fort, the sewage to be discharged by pumping into Chesapeake Bay. The estimated cost of such a system was $45,000, and on March 12, 1892, it was recommended that an additional appropriation of $20,000 be asked for, with such legislation as might be necessary to render available the $25,000 appropriated March 2, 1889, for a "complete" system.

May 31, 1892, the post surgeon made a report to the post adjutant upon the sanitary condition of the post. This was sent through the proper military channels, and finally was forwarded to the Secretary of War by the Surgeon-General of the Army, inviting the Secretary's attention "to what is regarded as the greatest sanitary error of this day." This report with its indorsements having been referred to the Chief of Engineers, that officer made reference to the authority given

to the Secretary of War by joint resolution No. 46, approved June 25, 1858, to remove any buildings thereafter erected upon United States lands at Fort Monroe whenever the Secretary should deem such removal necessary, and the suggestion was then made that the removal of the hotels might well be deemed necessary if their proprietors did not provide a satisfactory system of sewerage. It was then stated that with the approval of the Secretary of War the following action would be taken:

Notice will be given to all parties occupying, erecting, or about to erect buildings not belonging to the United States and on the military reservation of Fort Monroe, that the amended plans called for by letter of the Secretary of War, dated March 6, 1891, must be submitted for his approval on or before September 1, 1892; that the plans, when and as approved, must be executed and the sewerage system put in complete operation within six months after approval by the Secretary of War, and that upon failure to comply with either of these requirements action will be taken under the authority of the joint resolution above stated.

The letter of March 6, 1891, referred to in the Chief of Engineers' indorsement, was one addressed by Hon. Redfield Proctor, Secretary of War, to Mr. George C. Gorham, secretary of the Old Point Comfort Hotel Company, being a reply to a letter of Mr. Gorham, dated February 28, 1891, submitting on behalf of the property owners at Fort Monroe plans for a system of sewerage proposed to be used by them jointly with the Government.

The suggestions of the Chief of Engineers being approved, I was directed to carry them out. A circular letter was therefore sent to the various nonmilitary residents notifying them that the plans must be submitted before September 1, 1892, and the system be put in operation within six months after approval by the Secretary of War, and that upon failure to comply with either of these requirements action would be taken under the joint resolution to remove the buildings.

June 30, 1892, the post surgeon again made a report upon the sanitary condition of the post, which, after passing through the various military channels and being referred to me, was returned to the Chief of Engineers September 1, 1892, with the information that as no plans of sewerage had been received up to date, the proprietors of the three hotels had been notified to proceed at once to remove their buildings. Under further instructions the same notice was sent to all the other nonmilitary residents. Many letters were received from the parties at interest, protesting on various grounds against the action of the Secretary of War, but only the Chamberlin Hotel, an unfinished and unoccupied building, was excepted, with a proviso that a full compliance with the requirements of the War Department should be a condition precedent to further work upon the hotel.

September 5, 1892, the Surgeon-General addressed a letter to the Secretary of War upon this same subject, urging immediate action. Upon this letter the War Department indorsed that it was understood the Chief of Engineers had abandoned the idea of having a common system for the Government and private parties, and had determined that there should be one system for the Government and another for private parties; that if such a plan was to be carried out there ought to be no delay in constructing and putting in operation the Government system, at least to the full extent of the appropriation. The question being raised as to whether the $25,000 available—the wording of the act being "For construction, complete, of a sewerage system"—could be expended, as suggested by the Secretary of War, in the construction of a system the completion of which would require an additional appropriation, it was referred to the Acting Judge-Advocate-General, who gave it as his

opinion that it would be in violation of the law which contemplated the completion of the system with the appropriation made, it evidently being the intention of Congress to limit the cost of the work to that amount.

September 14, 1892, a Department letter was received requesting a report as to what action, if any, had been taken under the directions of the Secretary of War of October 29, 1891, in regard to the plan or suggestions as to what each hotel or private company and individual should be required to do in the matter of providing a system of sewerage for the private buildings on the reservation, and if no plan had been submitted, to submit one as early as practicable. In reply to this a report was submitted, September 16, 1892, outlining a plan for a sewerage system for the nonmilitary residents and making suggestions for the method of apportioning the cost.

A plan having been submitted by the Hygeia Hotel Company, the War Department, under date of September 15, 1892, indorsed on the communication that it might be impossible for the proprietors of that hotel to secure the coöperation of all the others, that they ought not to be held responsible for the refusal or neglect of others, and that the plan submitted for their own hotel should be considered and acted upon. Being referred to this office for remark and recommendation, objection was made to allowing exceptions to be made to the original plan of a joint system for all nonmilitary residents; that the Chamberlin Hotel had already been excepted by order of the Secretary of War, and if another exception were made in favor of the Hygeia Hotel the Sherwood House would demand the same priviledge, and, as the Catholic Church and the Chesapeake and Ohio Railroad Company, had already made the same request, we should soon have as many separate systems as residents, and the condition of affairs would soon be as objectionable as the present. It was recommended that the plan of a joint system be adhered to. This being approved by the Chief of Engineers, the Acting Secretary of War directed that the time for removing buildings be extended to October 31, 1892, it being the hope that by that time the plans would be fully perfected and agreed upon and that the work could be done in four months thereafter, thus bringing all parties—and perhaps the Government—into one system. It was then directed, September 28, 1892, to submit as soon as practicable a plan for the *entire* sewerage of Fort Monroe, with estimates of cost of construction and with schedules of distribution of cost and expense of running and maintenance.

Notification was sent at once to all the parties of the extension of time to October 31, 1892. Many plans were submitted by these people, but no joint or common plan.

October 26, 1892, a plan was submitted by this office for a joint system of sewerage for the entire reservation, at a total estimated cost of $75,000, with suggested regulations for the use of the system, estimated cost of maintenance, and a suggestion for a bill providing for the preservation, repair, and maintenance of the system, and a project for apportioning the cost based upon the number of occupants of the various buildings. The nonmilitary residents having expressed a willingness to comply with the orders of the Secretary of War and a readiness to coöperate with the Government in a joint system, it was recommended that they be notified to deposit the sum apportioned to each in a national bank to the credit of the Secretary of War. It was also suggested that, in view of the peculiar situation of affairs, special legislation might be necessary.

Attempts were made to secure the necessary legislation, a bill being drafted for the purpose by the Assistant Secretary of War, but the bill was not reported; no additional money was appropriated, nor was the $25,000 already allotted made available. No work can therefore be done.

Money statement.

July 1, 1892, balance unexpended	$24,902.10
July 1, 1893, balance unexpended	24,902.10
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	75,000.00

APPENDIX No. 7.

POST OF WILLETS POINT, NEW YORK—UNITED STATES ENGINEER SCHOOL—BATTALION OF ENGINEERS—ENGINEER DEPOT.

REPORT OF LIEUT. COL. W. R. KING, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

UNITED STATES ENGINEER SCHOOL,
Post of Willets Point, New York Harbor, July 17, 1893.

GENERAL: I have the honor to forward herewith duplicate annual report on the post of Willets Point, New York Harbor; the United States Engineer School; the Battalion of Engineers, and Engineer Depot, for the fiscal year ending June 30, 1893.

Very respectfully, your obedient servant,

W. R. KING,
Lieutenant-Colonel of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

I.—POST OF WILLETS POINT.

At the close of the fiscal year the garrison consisted of 21 commissioned officers and 335 enlisted men, including the following general staff and infantry officers:

Maj. Egon A. Koerper, surgeon, U. S. Army.
Capt. William P. Kendall, assistant surgeon, U. S. Army.
Second Lieut. Sidney S. Jordan, Fifth Artillery.
Second Lieut. Edward F. McGlachlin, jr., Fifth Artillery.
Second Lieut. Willis Uline, Twelfth Infantry.
Second Lieut. Walter M. Whitman, First Cavalry.

The following table shows the changes among the general staff and line officers at the post during the year:

Rank and organization.	Name.	Date.	Relieved or joined.
First Lieutenant, Eighth Infantry	Perry, John A	Oct. 1, 1892	Relieved.
Do	Martin, William F	July 18, 1892	Do.
Second Lieutenant, Twenty-first Infantry	Dwyer, Charles G	Oct. 1, 1892	Do.
Second Lieutenant, Twentieth Infantry	Humphrey, Harry D	do	Do.
Second Lieutenant, First Infantry	Tripp, Frederic A	do	Do.
Second Lieutenant, Sixteenth Infantry	Gregg, John C	do	Do.
Second Lieutenant, Second Infantry	Chrisman, Edward R	do	Do.
Major, Medical Department	Ewen, Clarence	Oct. 18, 1892	Do.
Second Lieutenant, Fifth Infantry	Keech, Frank B	Apr. 30, 1893	Do
Captain, Medical Department	Carter, W. Fitzhugh	May 18, 1893	Do.
Major, Medical Department	Koerper, Egon A	Oct. 17, 1892	Joined.
Captain, Medical Department	Kendall, William P	May 18, 1893	Do.
Second Lieutenant, Fifth Artillery	Jordan, Sidney S	Dec. 1, 1892	Do.
Do	McGlachlin, jr., Edward F	do	Do.
Do	Keech, Frank B	Nov. 7, 1892	Do.
Second Lieutenant, Twelfth Infantry	Uline, Willis	Nov. 30, 1892	Do.
Second Lieutenant, Second Infantry	Whitman, Walter M	Dec. 1, 1892	Do.

BUILDINGS AND OTHER IMPROVEMENTS.

During the year the following work has been done under the post quartermaster (Lieut. Henry Jervey until March 11 and Lieut. Edgar Jadwin since that date) with funds allotted by the Quartermaster's Department, supplemented as far as practicable by the labor of the garrison:

1. The new guardhouse has been completed and occupied, and is found well adapted to the purpose for which it was designed.

2. The old guardhouse has been removed to a suitable site in the grove near the line of barracks and is being fitted up as quarters for the band sergeant.

3. The two brick barracks which were begun during the previous fiscal year have been somewhat delayed by the inefficiency of the contractors, but they are now nearly completed and will soon be occupied. A third barrack, which will complete the housing of the three companies stationed here, has recently been authorized, and will be placed under contract at an early day.

4. Some extensions and repairs have been made to the quartermaster's wharf, roads, sidewalks, drains, and sewers, and the usual amount of labor and materials have been applied to the preservation and repair of public buildings.

5. At the suggestion of the post quartermaster, the Long Island Railroad Company has expended $200 in building a suitable landing near the station of Whitestone Landing for the small boat that runs between that point and Willets Point and Fort Schuyler.

The most important improvements still unprovided for are the building of a quartermaster and commissary storehouse near the wharf, the cleaning out of the ditch bounding the Government lands on the southwest, the walling in of the ice pond, and the lighting of the post by electricity.

The necessity for these improvements has been set forth in former reports, and plans and estimates have been prepared. Without going into details that have been already reported, it may be stated in brief that the cleaning out of the ditch and walling in of the ice pond would improve the sanitary condition of the post by getting rid of a swampy margin that now borders the ditch and pond, would prevent surface water from running directly into the latter, and greatly improve the

uality of the ice, which is now deemed unsafe for use excepting for in-rect cooling of water.

The quartermaster and commissary storehouse is needed to replace d and dilapidated frame buildings, and by its location near the wharf, here all supplies are landed, to save an enormous amount of labor in uling freight the entire length of the post, or about half a mile.

The electric lighting of the post should be provided for because, with ir facilities in machinery and mechanics, it can be done at a moderate st, and would dispense with some hundreds of oil lamps, which now nsume about 800 gallons of oil per month If it is proposed to adopt odern methods of lighting military posts, it is believed that it could e tried here at smaller cost for plant and with greater prospect of onomical results in operating than at any other post.

II.—UNITED STATES ENGINEER SCHOOL.

The scope and object of the school have been fully set forth in pre-ious reports and in the order establishing it on its present basis; the rders issued in pursuance of the latter, arranging the details of the eason's work, are appended, marked A, B, and C.

During the present year a class of three engineer officers completed he full course of two and one-half years, and seven officers of infantry ompleted their course of torpedo instruction.

* * * * * * *

III.—BATTALION OF ENGINEERS.

The law provides for five companies of engineer troops, having an gregate strength of 752 enlisted men, officered by detail from the Corps Engineers.

At present only four companies with a total strength of 500 enlisted en are allowed to be recruited.

The aggregate strength of the Battalion of Engineers on June 30, 93, including Company E, stationed at West Point, N. Y., was 18 nmissioned officers and 418 enlisted men.

During the year Companies A, B, and C have been stationed at illets Point; Company D exists in name only; Company E has been tioned at West Point, to assist in the practical instruction of cadets the Military Academy, in building military bridges, sapping, mining, d signaling.

* * * * * * *

Second-Lieut. Edgar Jadwin, Corps of Engineers, was relieved from ty with Company B, Battalion of Engineers, and appointed acting ttalion quartermaster to date March 11, 1893, in Orders No. 26, Head-arters, Battalion of Engineers, Willets Point, March 3, 1893. Ap-inted acting assistant quartermaster post of Willets Point, to date rch 11, 1893, and assistant commissary of subsistance, post af Will-s Point, to date March 1, 1893, in Orders No. 38, post of Willets Point, w York Harbor, March 3, 1893. Appointed quartermaster Battalion Engineers, March 11, 1893, in Orders No. 32, Headquarters Battalion Engineers, Willets Point, March 11, 1893, as authorized by letter m the Secretary of War, dated War Department, Adjutant-Gen-al's Office, Washington, D. C., March 18, 1893.

Second-Lieut. Jay J. Morrow, Corps of Engineers, was transferred m Company A to Company C, Battalion of Engineers, October 11, 92, in Orders No. 110, Headquarters Battalion of Engineers, Willets int, October 10, 1892.

Second-Lieut. Charles S. Bromwell, Corps of Engineers, was relieved from duty with Company A, Battalion of Engineers, May 30, 1893, in Orders No. 37, Headquarters Battalion of Engineers, Willets Point, May 30, 1893, in compliance with Special Orders No. 117, Headquarters Army, Adjutant-General's Office, Washington, D. C., May 24, 1893; assigned to duty with Company E, Battalion of Engineers, same order.

The following table shows the changes that have taken place in the personnel of the officers during the year, viz:

Rank.	Name.	Date.	Joined or relieved.	Remarks.
Captain	Sears, Clinton B	Sept. 22, 1892	Relieved	S. O. 200, A. G. O. Aug. 25, 1892.
Second lieutenant	Cavanaugh, James B	Sept. 30, 1892	Joined	S. O. 208, A. G. O. Sept. 8, 1892.
Do	Jervey, James P	do	...do	Do.
Captain	Fiak, Walter L	Oct. 15, 1892	...do	S. O. 200, A. G. O., Aug. 25, 1892.
Do	Derby, George McC	Mar. 4, 1893	Relieved	S. O. 46, A. G. O., Mar. 1, 1893.
First lieutenant	Jervey, Henry	Mar. 11, 1893	...do	S. O. 43, A. G. O., Feb. 25, 1893.
Captain	Lusk, James L	Mar. 31, 1893	Joined	S. O. 46, A. G. O., Mar. 1, 1893.
Second lieutenant	McKinstry, Charles H.	May 31, 1893	Relieved	S. O. 117, A. G. O., May 24, 1893.

RECRUITING, DISCIPLINE, ETC.

During the year recruits for the battalion have been obtained by enlistments at Willets Point and West Point, and by assignment on their own application from recruiting rendezvous or other branches of the service.

An engineer sergeant was detailed to recruit for the Battalion of Engineers on February 17, 1893, and was attached by the superintendent of recruiting service to rendezvous No. 146 Park Row, New York City.

The following is a statement of changes among the enlisted men of the battalion during the past year:

Gain:

Recruits from depot	26
Enlisted in battalion (Willets Point, 35; West Point, 28)	63
Reënlisted in battalion (Willets Point, 22; West Point, 9)	31
By transfer	6
From desertion	9
Total gain	135

Loss:

Discharged by expiration of service	30
for disability	1
by sentence of general courts-martial	11
by Special Orders	5
by General Orders 80, Adjutant-General's Office, series 1890	57
by General Orders 81, Adjutant-General's Office, series 1890	21
Transferred	5
Retired	1
Died	3
Deserted	1
Total loss	135

The net loss, 19 men, is due to the operation of General Orders 80 and 81, series 1890.

During the fiscal year ending June 30, 1893, 110 men of the Battalion of Engineers were entitled to be discharged under the provisions of par. 2, General Orders No. 80, Adjutant-General's Office, 1890, 57 of whom availed themselves of this privilege.

Seventy-two enlisted men were on furlough during the year, under the provisions of General Orders No. 80, Adjutant-General's Office, 1890.

The following table gives a comparative statement of recruiting, desertions, etc., during the past nine years:

Fiscal year.	Recruiting.		Average daily number.		Deserted.	Trials.			No. of men on June 30.
	Enlisted.	Reënlisted.	Arrest or confinement.	Sick.		General court-martial.	Garrison court-martial.	Summary court.	
ne 30, 1884, to June 30, 1885...	56	30	6	18	106	11	59		383
ne 30, 1885, to June 30, 1886...	57	38	8	22	76	20	107		396
ne 30, 1886, to June 30, 1887...	20	28	9	17	49	19	160		388
ne 30, 1887, to June 30, 1888...	9	24	12	22	49	21	218		387
ne 30, 1888, to June 30, 1889...	90	29	6	20	23	4	214		402
ne 30, 1889, to June 30, 1890...	147	64	9	14	52	13	304		468
ne 30, 1890, to June 30, 1891...	50	59	6	12	15	12	60	138	417
ne 30, 1891, to June 30, 1892...	83	42	5	10	24	19	4	208	437
ne 30, 1892, to June 30, 1893...	63	31	6	11	17*	18	8	156	418

*One man surrendered since June 30, 1893.

It will be seen from this table that the number of enlisted men is ill above the average for the past nine years, that there has been a lling off of about one-fourth in the number of trials for minor offenses, hile the number of desertions is less than at any time except the year 91, and the number of sick and of men in confinement are below the verage.

The following statement shows the number of different men tried by ourt-martial and other facts relative to the trials:

	Trials.
y general court	18
y summary court	156
bjected to trial by summary court and tried by garrison court	8
Total	182

	No. of men.	No. of trials.
ed once	43	43
ed twice	26	52
ed 3 times	9	27
ed 4 times	6	24
ed 5 times	0	0
ed 6 times	6	36
Total	90	182

mber of men who pleaded guilty	150
mber of men who pleaded not guilty	32
Total	182
mber of acquittals	10
mber found guilty	172
Total	182

The combined mess for the three companies and band has continued successful operation, and is now under charge of Lieut. J. J. Morw, acting under the immediate supervision of the mess council. very effort has been made to secure a plentiful supply and variety of holesome and well-cooked food for the men.

The post exchange, under charge of Lieut. Spencer Cosby, has also en in successful operation, and a considerable increase has been made the variety of articles kept on sale.

The experience of the past year has still further confirmed the opinion expressed in former reports that the present system of discharging men should be abolished and the term of enlistment reduced to three years with a reënlistment furlough of one or two months, as formerly. The assumption that any man of ordinary prudence and intelligence knows what he is doing when he signs a contract to serve the United States five years, under the present complicated system of retained pay, detained pay, extra duty pay, length of service pay, commutation of rations and clothing allowances, which vary from year to year, etc., which often call for the most careful study by those who have had years of experience in such matters to ascertain what a man's rights are, is certainly a violent assumption, and the probability is that in nine cases out of ten the recruit takes the oath blindly or at best with only a vague notion of what he is to receive or how long he will be contented to remain in service. It is not likely that an ordinary farm hand or mechanic would bind himself to serve the best employer in the country for five years under such terms.

The comparatively simple operation of getting a man out of the service at the end of three years, which could be accomplished in a few minutes at the post under a three years term of enlistment law, now requires a correspondence which, including the two applications and their indorsements, two sets of printed orders and receipts and ration papers, involves an expenditure of more than a quire of paper for each man who receives his furlough and discharge.

This of course would be a small matter if there were any substantial advantage to be gained by it, but on the contrary the effect of the present system is to create uncertainty and uneasiness on the part of the men as well as of the officers. During the past year no less than seventy-two men have been absent three months each, during which time their comrades have had to perform their duties, and their places could not be filled because it was not known whether they would return or take their discharge at the end of their furlough. In most cases these men took their furlough, not because they wanted one, but in order to accept employment elsewhere and thus draw two salaries. The demoralizing effect of such a system is too apparent to require statement.

The principle of buying discharges is also believed to be based on what should be an entirely erroneous assumption, viz, that the soldier has in some way been entrapped into selling his time for less than its market value.

The soldier's profession is supposed to be an honorable one, and yet he is classed in this respect with criminals who "want to get out," while the lowest scrub-out in the Government employ would not only smile at a proposition to buy his way out of the service, but would know that there were plenty of people ready to take his place.

The trouble is that the Government has been trying to get soldiers at a little below the market price and with the usual result of such experiments. If this were not so there would be no trouble in getting plenty of recruits, and not only that, but a discharge from the service would cease to be a "favor;" and instead of being obliged to take every one who will pass inspection, the service would be enabled to select its men just as is done in civil service.

This state of things was nearly realized in the Battalion of Engineers just before the laws in question went into effect, and Company E at West Point actually had a number of applicants waiting for vacancies. The great advantage to the service of such a state of things can hardly

be overestimated. It would improve the character of the personnel, diminish the number of desertions, and promote the discipline and efficiency of the service.

I would also respectfully renew my recommendation that the 11 o'clock check roll call be changed to 9:30 p. m.

I would also respectfully recommend the repeal or radical modification of the law of February 27, 1893, prohibiting the reënlistment of men who have served ten years, etc.

In a theoretical point of view there would be manifest advantages in thus limiting the age and term of service of enlisted men, provided there were plenty of young and equally efficient men to take their places; but as we are unable to keep the ranks filled, under such conditions, it would hardly be good "policy" to tie the hands of the recruiting officers by such an inflexible law, even if it were the part of "honesty" to deprive men who have served ten years of a part of the reward held out to them as an inducement to enter the service.

DRILL AND INSTRUCTION.

During the year the Battalion of Engineers has been drilled and instructed as follows:

1. Infantry tactics: School of the soldier, company, and battalion.

2. Target practice: The practice season for the post of Willets Point, New York Harbor, for the past year was from July 18, 1892, to September 15, 1892, and at West Point, N. Y., during the months of July and August, 1892. Owing to the objections by citizens living in the neighborhood to the use of the rifle range at this post, no regular target practice could be had. A suitable butt, with targets for firing at short ranges and with reduced charges, built at this post in 1891, was thoroughly repaired during the first two weeks of July, 1892.

Target practice was held daily by companies in turn, superintended by the company commanders.

3. Pontooniering during the months of September and October.

4. Military engineering. Foot reconnaissance, tracing and profiling field fortifications, construction of spar bridges, double lock, including knots and lashings, during the month of November, 1892.

5. Torpedo drills were had throughout the year, the winter months being devoted to indoor drills and practice in the loading room, and the summer months in outdoor drills and exercises.

The following number of men received instructions during the winter months, viz: 20 sergeants, 29 corporals, and 242 privates.

Qualification of privates:	
First class	200
Second class	42
Total	242

Three men received no instruction during indoor season, viz: 1 man on furlough for three months; 1 man in confinement during entire season; 1 man sick in hospital and furlough during entire season.

During the summer months, 7 grand groups were planted, which required 7 different details by roster, each detail consisting of 3 commissioned officers, 3 noncommissioned officers, and 12 privates.

6. Photography. Selected details of noncommissioned officers have been instructed in military photography.

7. In order to facilitate the learning of the various industrial trades by enlisted men, and furnish men qualified for special duty as carpenters,

blacksmiths, engine-drivers, etc., a detail of 4 men from each company was employed under the supervision of Lieut. John S. Sewell, Corps of Engineers, to act as assistants to the mechanics at work in the different shops on the post, when not on other duty. This duty was voluntary, and the men were allowed to select the trades they were to learn. If they made satisfactory progress, they were considered eligible for special details when vacancies occur, but if not they were replaced by others, and a record was kept of the progress made by each man for future reference.

8. Telegraphy and signaling. All company noncommissioned officers received instruction in signaling during the month of June, 1893, and considerable progress was made.

9. The post schools for enlisted men and for the children living on the Post were under the supervision of Lieut. John S. Sewell, Corps of Engineers, and have been well conducted. Thirty-nine enlisted men and 57 children between the ages of 5 and 15 have received appropriate instruction.

ENGINEER DEPOT.

PUBLIC BUILDINGS, BOATS, ETC.

I. The fireproof storehouse referred to in last report has been completed and large quantities of torpedo, pontoon, and siege materials and appliances have been stored in it. Had this building been built by contract it could hardly have been completed inside of the appropriation, certainly not as substantially as it has been made. But by using engineer soldiers for a considerable part of the work, including excavation, laying foundations and stone masonry, and putting up iron frames for floor and roof, a saving of $2,931.21 has been effected, and it is respectfully recommended that Congress be requested to authorize this balance to be expended in establishing a plant for lighting the public buildings of the post by electricity. This is a much-needed improvement, and it is believed that by utilizing such machinery and materials as are now available and not needed for other purposes, the post can be lighted much better than at present and dispense with the very objectionable use of a large number of oil lamps.

II. The new torpedo planter has been completed by the contractors and has been fitted with steam-hoisting machinery and other appliances for handling torpedoes, cables, anchors, etc., and is now in use for the torpedo drills and experiments. This boat is 45 feet 9 inches long and 12 feet and 6 inches beam, and has ample steam power to enable it to move rapidly from point to point and is easily handled in stopping, starting, and changing direction, which are very important items in planting torpedoes.

III. An additional concrete cable tank has been constructed and is now ready for the cable recently advertised for. This tank is 55 feet long, 14 feet wide, and 9 feet deep, and can be filled and emptied by gravity, the water supply being taken from the ice pond.

IV. Sixteen new pontoon boats, 8 of which are of wood and 8 of canvas, have been purchased under contract and delivered. Four more of wood and 6 of canvas have been ordered, and with the necessary lumber for 1,300 chess for the canvas train, should have been delivered before the 1st of July, but are now promised at an early day.

A considerable quantity of cordage for mooring rope and lashings and other materials for pontoon bridge has been procured.

DEPOT PROPERTY AND WORK OF DEPOT.

ng the items of work done in the way of procuring and caring
ineer property in the depot may be mentioned—
ie purchase by contract of 50 miles of insulated cable for sub-
mining. This cable is to be in equal quantities of single and
le cable, and sample drums of each are now being made.
The purchase and shipping of a large quantity of materials and
tus to San Francisco and Sandy Hook.
The preparation and shipment of a number of models to the
bian Exposition at Chicago.
The refitting of 1,200 cells of Leclanché firing battery, which
come unserviceable by chemical action during storage.
The fitting up of tables, shelves, etc., in the library and model
or additional books, maps, and models. In addition to the books
ineering and kindred scientific subjects, procured by purchase
the year, there were received quite a number from the estate
late Gen. George W. Cullum, which were bequeathed by him to
rary of the U. S. Engineer School.
ther valuable addition to the library was made about a year ago
ut. James G. Warren, U. S. Engineers, who donated some 277
s of standard works to it from his private collection.
The various kinds of instruments on hand have been properly
or, and the following additions have been made during the year
chase under formal proposals, viz:

engineer transits, 1 chronometer break circuit, 10 odometers, 10 prismatic
es, 12 hand levels, 3 pedometers, 3 clinometers, 1 standard steel tape (100
d 1 steel tape chain (300 feet).

receipts and issues during the past year of instruments, for use
ers engaged on surveys, reconnaissances, and other public works,
ontinued.
following instruments were issued, upon requisitions, duly author-
the Chief of Engineers, U. S. A., viz:

stronomical transit, 1 astronomical clock, 1 zenith telescope, 3 chronome-
ak circuit, 1 chronograph, 5 sextants, 2 trivets, 3 barometers, aneroid, 2
eters, 2 theodolites, 9 engineer transits, 3 surveyors' levels, 3 level rods, 4
ods, 1 switch board, 1 spyglass, 14 binocular field glasses, 1 odometer, 3
extants, 2 pedometers, 2 clinometers, 8 prismatic compasses, 12 pocket com-
18 hand levels, 1 calculating scale, 16 Abbot's protractors, 1 circular pro-
1 proportional dividers, 1 T square, 3 triangles and curves, 1 metallic tape
), 2 steel tapes (100 feet), 2 steel tapes (50 feet), 3 Siemens galvanometers,
y's galvanometers, 3 bridge rheostats, 3 resistance coils, and a number of
struments which were temporarily issued to surveying parties for survey-
ions of Long Island and for hydrographical surveys of the Long Island
the vicinity of this post.

following instruments were sent to Fort Wingate, N. Mex., for
surveying the Navajo Indian Reservation, and have been re-
after being used in the field for about four months, and are not
d in the foregoing issues, viz:

engineer transits, 3 engineer levels, 3 level rods, 3 clinometers, 3 pedome-
and levels, 3 stadia rods, 3 surveyors' chains (100 feet), 3 sets chain pins,
eroid barometer.

following instruments were received during the year from officers
eys and public works, viz:

astronomical transits, 1 astronomical telescope, 1 zenith telescope, 3 arti-
rizons, 3 sextants, 5 chronometers, 2 pocket chronometers, 2 relays, mag-
nders, and keys, 8 aneroid barometers, 4 mercury cistern barometers, 1

ments in a small building erected near the cable tanks for that purpose, and carefully tested each of the 252 separate cores for insulation resistance. During the past month he has repeated the tests of one core of each cable on seven different days, for the purpose of observing the effect of atmospheric conditions on the measurements. The results showed that the measurements obtained on dry, hot days were very much higher than on damp, cloudy days, the difference amounting in some cases to more than ten times the smaller figure. The results of these tests have been recorded, to be compared with other measurements made from time to time to ascertain how the cable is holding its insulation.

VI. A large number of explosives have been tested during the year by Sergt. Brown, some of which were with new varieties, but most of them had been on hand for several years, and the tests were to ascertain the effect of time on their strength and sensitiveness.

The results in each case were remarkably uniform for the same explosive, when treated in the same way, and taken in connection with those of experiments made in former years furnish many useful suggestions relative to the strength and stability of the different explosives tested.

VII. The trials of the Sims-Edison fish torpedo, made by the Sims-Edison Company under contract of March 24, 1891, were continued, and some fourteen additional runs and several dock trials were made during the year.

The results of these trials, with charts of the runs and electrical data connected therewith, have been forwarded to the Chief of Engineers, with recommendations as to the acceptance of the torpedo under the terms of the contract.

It was specified in the contract that the torpedo must carry 11,000 feet of cable and 450 pounds of dynamite, make a speed of at least 18 miles an hour over a one-mile course, that it must steer to the right and left within a radius of 300 feet, and dive under a floating spar while running at full speed, etc. These conditions have been finally complied with so as to justify the acceptance of the torpedo.

* * * * * * *

STATEMENT OF FUNDS.

I. *Engineer depot at Willets Point, New York.*—Congress appropriated for the fiscal year ending June 30, 1893:

1. For incidental expenses of depot (incidentals)	$4,000.00
2. For purchase of materials for instruction of battalion (materials)	3,500.00
3. For purchase and repair of instruments (instruments)	2,000.00
4. For purchase and binding of professional works of recent date treating of military and civil engineering (library)	500.00
5. For purchase of pontoon material (pontoon materials)	5,000.00
Total	15,000.00

Of this there has been expended and pledged:

1. For incidental expenses of depot (incidentals)	$4,000.00
2. For purchase of materials for instruction of battalion (materials)	3,500.00
3. For purchase and repair of instruments (instruments)	2,000.00
4. For purchase and binding of professional works of recent date treating of military and civil engineering (library)	500.00
5. For purchase of pontoon material (pontoon materials)	5,000.00
Total	15,000.00

The following item from the act approved February 24, 1891, and designated for the engineer depot at Willets Point, N. Y., was assigned to me for disbursement and is available until expended:

6. For a fireproof building to replace engineer depot storehouse destroyed by fire May 10, 1890 (storehouse)	$16,000.00
July 1, 1892, balance unexpended	3,531.66
June 30, 1893, amount expended during fiscal year	600.45
July 1, 1893, balance unexpended and available	2,931.21

II. *Torpedoes for harbor defense (act September 22, 1888).*—Congress appropriated under the above act the sum of $200,000, from which the amount of $98,000 has been assigned to me for disbursement and is available until expended:

July 1, 1892, balance unexpended	$5,088.33
June 30, 1893, amount expended during fiscal year	88.33
July 1, 1893, balance unexpended and available	5,000.00

III. *Torpedoes for harbor defense (act March 2, 1889.*—1. The act of Congress making appropriations for fortifications, etc., approved March 2, 1889, appropriated under the general title "Torpedoes for harbor defense" the sum of $250,000 for purchase of submarine mines and necessary appliances, and $30,000 for torpedo experiments and instruction of engineer troops in submarine mining. These amounts were assigned to me for disbursement and are available until expended:

July 1, 1892, balance unexpended	$29,509.33
June 30, 1893, amount expended during fiscal year	14,486.73
July 1, 1893, balance unexpended	15,022.60
July 1, 1893, outstanding liabilities	398.20
July 1, 1893, balance available	14,624.40

2. From the appropriation for purchase of movable submarine torpedoes, from act of March 2, 1889, the sum of $25,225 was assigned to me for disbursement and is available until expended:

July 1, 1892, balance unexpended	$22,100.00
June 30, 1893, amount expended during fiscal year	20,725.00
July 1, 1893, balance unexpended	1,375.00
July 1, 1893, amount covered by uncompleted contract	1,375.00

3. From the appropriation for submarine mines and necessary appliances, act of March 2, 1889, for construction of concrete tanks for wet storage of mining cable, the sum of $5,000 was assigned to me for disbursement and is available until expended:

July 1, 1892, balance unexpended	$3,266.12
June 30, 1893, amount expended during fiscal year	1,300.85
July 1, 1893, balance unexpended and available	1,965.27

IV. *Torpedoes for harbor defense (act of Aug. 18, 1890).*—Under the above act the following amounts were assigned to me for disbursement and are available until expended, viz:

1. For submarine mines and necessary appliances for storage at Hampton Roads and Portland, Me., and charge bags for Boston, New York, and San Francisco, Cal	$100.000
July 1, 1892, balance unexpended	3,745.65
June 30, 1893, amount expended during fiscal year	2,137.50
July 1, 1893, balance unexpended and available	1,608.15

2. For continuing torpedo experiments and instruction of engineer troops in submarine mining	$30,000.00
July 1, 1892, balance unexpended	22,990.70
July 1, 1893, balance unexpended and available	22,990.70

V. *Torpedoes for harbor defense* (*act February 24, 1891*).—Under the above act the sum of $21,605 for tool boxes, etc., for storage at Willets Point, N. Y., and for submarine mines and necessary appliances for storage at Charleston Harbor, was assigned to me for disbursement and is available until expended:

July 1, 1892, balance unexpended	$833.70
June 30, 1893, amount expended during fiscal year	750.00
July 1, 1893, balance unexpended and available	83.70

VI. *Torpedoes for harbor defense.*—The following sums, which were withdrawn during previous fiscal year and restored to their original appropriations, have been reallotted under date of February 13, 1892, to be applied to the purchase of American manufactured submarine torpedo cable. These amounts were assigned to me for disbursement and are available until expended, viz:

1. From act of March 2, 1889		$49,859.26
2. From act of August 18, 1890		25,101.86
Total		74,961.12
July 1, 1892, balance unexpended		74,961.12
June 30, 1893, amount expended during fiscal year	None.	
July 1, 1893, outstanding liabilities	$20.60	
July 1, 1893, amount covered by contract to be approved	42,500.00	
		42,520.60
July 1, 1893, balance available		32,440.52

NEW APPROPRIATIONS.

The following items have been appropriated for the engineer depot at Willets Point, N. Y., for the fiscal year ending June 30, 1894, viz:

1. For incidental expenses of depot (incidentals)	$4,000.00
2. For purchase of materials for instruction of battalion (materials)	3,500.00
3. For purchase and repair of instruments (instruments)	3,000.00
4. For purchase and binding of professional works of recent date, treating of military and civil engineering (library)	500.00
Total	11,000.00

ESTIMATES.

There will be required for the fiscal year ending June 30, 1895, the following for engineer depot at Willets Point, N. Y., viz.:

1. For incidental expenses of depot, including fuel, light, chemicals, stationery, hardware, extra-duty pay to soldiers necessarily employed as artificers on work in addition to, and not strictly in the line of, their military duties, such as carpenters, draftsmen, clerks, blacksmiths, printers, bookbinders, photographers, lithographers, engine-drivers, wheelwrights, masons, teamsters, machinists, painters, overseers, and laborers, and for materials to repair public buildings, machinery, and unforeseen expenses	$5,000.00
2. For purchase of materials for the instruction of engineer troops at Willets Point, N. Y., in their special duties as sappers and miners, for land and submarine mines, and pontoniers, torpedo drill, and signaling	3,500.00

3. For purchase and repair to instruments to be issued to officers of the Corps of Engineers and to officers detailed on duty as acting engineer officers for use on public works, surveys, and reconnaissances.	$3,000.00
4. For library of engineer school: For purchase and binding of professional works of recent date, treating of military and civil engineering and kindred scientific subjects	500.00
Total	12,000.00

APPENDIX A.—PROGRAMME OF STUDY AND INSTRUCTION FOR SUMMER SEASON.

[Printed Orders, No. 74.]

UNITED STATES ENGINEER SCHOOL,
Post of Willets Point, New York Harbor, May 2, 1892.

The following programme of study and instruction for the ensuing summer season, to commence May 9 and end November 14, 1892 (28 weeks), having been recommended by the academic staff and approved by the Chief of Engineers, will be carried into effect.

A roster of the student officers will be kept by the post adjutant, who will make weekly details for the various duties so that they shall not conflict.

I. MILITARY ENGINEERING.

1. Instruction by the company officers in the nomenclature, dimensions, and construction of modern siege batteries and saps.
2. A full course of trestle and ponton bridge drill.
3. Instruction in building spar bridges.
4. Instruction in military mining.
5. Military map making. Each lieutenant of engineers who has not already done so, and such non-commissioned officers and privates as may be selected from each company, will make satisfactory foot reconnaissances about four miles long, in the vicinity of the post, the maps thereof to be submitted by company commanders to post headquarters on or before November 14, 1892.

II. TORPEDO DRILLS.

6. After receiving such preliminary practice as may be necessary to acquaint them with the practical details of preparing and planting a torpedo, the officers of the torpedo class will be divided into details of at least two officers each, for the purpose of taking charge of the preparation and planting of a grand group of torpedoes, under the direction of the instructor in torpedoes, assisted by one engineer officer of the second or third winter's class.
7. The senior officer will be in general charge, and will keep a daily journal of operations, noting particularly any difficulties encountered and any suggestions that may occur to him looking to the avoidance of similar difficulties in the future.
8. The officers will frequently interchange duties so that each one shall have some experience in each part of the drill.
9. The electric light will be set up and operated.
10. The grand group being completed and the search light in position, the post commander will order an exhibition drill illustrating the operations of the torpedo defense against an attempted passage of the mine field by an enemy's vessel under cover of night.
11. The group will then be taken up by the same detail and the parts dismantled, cleaned, and conveniently grouped for the inspection of the instructor.
12. The detail will be instructed and exercised in automatic and judgment firing drills at such times as may be most convenient before the final exhibition drill.
13. The detail of enlisted men for each grand group drill will consist of 3 non-commissioned officers and about 12 privates.
14. The hours of work will be from 7 to 11:30 a. m. and from 1 to 4:30 p. m. In bad weather when no work is done and the men are in barracks the latter will attend the same company duties and roll calls as daily duty men.
15. Weekly reports of progress will be rendered by the senior officer of the detail, and at the conclusion of the work each officer will submit a report of the work done by him, mentioning difficulties encountered and any suggestions he may desire to make.

A detailed record will be kept of what each man does, with the view of tracing
e author of defective work and determining the degree of proficiency devel-
y individual members of the detail. An account of the character of work
y each man will be submitted by the senior officer with his final report.
Occasionally, if practicable, loaded mines will be planted and fired as in actual
, height of jet, effect on neighboring mines, and other phenomena being care-
bserved and recorded.
At such times as will not interfere with the drills above mentioned, the officers
class will make practical experiments in calibrating commercial ammeters
ltmeters, testing efficiency of dynamos and motors.

III. CIVIL ENGINEERING.

A topographical survey of about one-half square mile of ground by each
of the first summer's class. Time allotted, five weeks.
A hydrographic survey of about one-quarter square mile by each officer of the
summer's class. Time allotted, four weeks.
Practical problems in civil engineering by the second summer's class. Time
d, seven weeks.
While engaged in the field work in topographical and hydrographic surveys
icers will be assisted by details of enlisted men and will be excused from all
luties.

IV. FIELD ASTRONOMY.

All the lieutenants of engineers who have not already completed the course and
xcused from further observations will constitute the observers, being called
y the officer in charge as wanted.
The following system will govern the observations at the observatory. The
covers two seasons—the first including theory and use of astronomical instru-
and sextant, transit, and telescope work with the instruments in the east
nd on the outer pier; and the second including sextant work and transit and
telescope work, and with chronograph with the new combined instruments in
st wing.
Officers wishing to use the instruments for special observations or practice
pply for authority to do so, and are not permitted to handle any instruments
specifically assigned to them by the instructor.
n case of damage to instruments or apparatus it will be promptly reported
instructor for the action of a board of survey.
The following will be the ordinary routine of observations with the several
nents, after reasonable proficiency has been attained by preliminary practice:
ant.—After becoming skillful in the use of this instrument upon the sun, ob-
will deduce at least one satisfactory latitude by observing a north and a
tar, using the time deduced from an east and a west star—each based on ten
es taken on the same night. These observations for latitude and time must be
t the observatory. The observer may get "time" from an assistant, using a
le chronometer, and will determine, by comparison, the error of standard
meter at observatory.
nograph.—Daily determination, by time signal from Washington, D. C., of
nd rate of astronomical clock by the officer of the day.
sit.—A satisfactory set of time observations will be taken by each officer on
ghts, successive, if possible, determining satisfactorily the error of siderial
The junior class will employ the eye and ear method; the senior class will
chronograph. The observer will not receive any assistance.
h telescope.—Observers will first determine the level correction by daylight,
a distant terrestrial object, or at night using a slow circumpolar star. They
an find the value of a turn of the micrometer by observing Polaris at elongation.
, they will observe for latitude, until they have obtained a satisfactory de-
ation.
uitable blank forms will be provided, both for observations and computa-
and all problems must be submitted, complete in every detail, upon these
The original records, after inspection by the commanding officer, will be re-
to the officers as their personal property.
Hours of attendance at the observatory will be, for both classes, daily, except
ay and Sunday, from 8 to 10 a. m., from 2 to 4 p. m., and from 8 to 10 p. m.
g hours will be extended when it is necessary to secure complete sets of ob-
ons.

V. MILITARY PHOTOGRAPHY.

30. The officers' laboratory will be opened daily from 1:30 p. m. to 4 p. m.
31. The building, apparatus, chemicals, etc., will be under the charge of the battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.
32. Officers are invited to avail themselves of the advantages of the laboratory, making such arrangements with the officer in charge as shall insure no confusion in his official duties or in those of the men under his instruction.
33. The instruction of enlisted men will be restricted to a weekly detail of one noncommissioned officer from each company.
34. The battalion quartermaster will submit to this office weekly reports showing the *nature of the instruction given*, the results attained, and the progress made.

By order of Lieut. Col. King:

ROBERT MCGREGOR,
Second Lieutenant of Engineers, Post Adjutant.

APPENDIX B.—PROGRAMME OF STUDY AND INSTRUCTION FOR WINTER SEASON.

(Printed Orders, No. 214.)

UNITED STATES ENGINEER SCHOOL,
Willets Point, New York Harbor, November 22, 1892.

I. The following programme of study and instructions for the ensuing winter season, commencing Thursday, December 1, 1892, and ending May 31, 1893, having been recommended by the academic staff and approved by the Chief of Engineers, will be carried into effect:

COURSE FOR OFFICERS.

1. Details of student officers for academic duty will be made weekly by the post adjutant. Officers will devote six hours daily to such duty, Saturdays and Sundays excepted, and excepting time consumed in sessions of general courts-martial. Each officer will record daily, in a book provided for that purpose, the disposition of his time for the previous day. Instructors will meet their classes at least weekly for assignment of lessons and examinations. As far as needful they will supplement the course with lectures. Examinations by the academic staff will be held about the end of February and of May. Marks at all examinations will be on the West Point system, and the results will be reported weekly to the commandant of the school.

FIRST WINTER'S COURSE.

2. The course for engineer officers spending their first winter at the school will be: Electricity and torpedoes, twenty-one weeks; surveying, three weeks. For officers of other arms of the service detailed for special instruction in the torpedo service: Electricity and torpedoes, twenty-four weeks.

ELECTRICITY.

3. Study of, in its application to torpedo warfare, arc and incandescent lighting, and transmission of power, supplemented by extensive laboratory practice in the solution of the special problems involved. Text-books and books of reference as follows: Abbot's Notes on Electricity; Ayrton's Practical Electricity; Thompson's Electricity and Magnetism; Maier's Arc and Glow Lamps; Swinburne's Practical Electrical Measurements; Kapp's Electrical Transmission of Energy; Part II of Professional Papers No. 23, Corps of Engineers, U. S. Army; Gray's Absolute Measurements, Vol. II; Monroe and Jamieson's Pocket Book of Electrical Rules and Tables.

TORPEDOES.

4. Text-book: The Torpedo Manual. Practice will be had in making all the adjustments and tests required in planting and operating torpedoes, the operations on the water being simulated as far as practicable by special indoor appliances.

Books of reference: Bucknill's Submarine Mines and Torpedoes as Applied to Harbor Defense; Scheidnagle's Treatise upon Defensive Submarine Mining.

5. Attendance at the electrical laboratory will be regulated by the instructor. All laboratory work will be done without the use of text-books or text-book diagrams. Officers may, however, use manuscript notes or diagrams previously prepared. Laboratory practice will be had from 9 a. m. to 12 m., and from 1 to 4 p. m. During the last two weeks of the course each engineer officer will prepare a plan (map and memoir) for the defense of such harbor as may be designated by the instructor, special attention being given to the torpedo defense and the batteries protecting the torpedo lines.

SURVEYING.

6. Subjects: (1) Adjustment, use, and care of instruments; (2) Topographical surveying with transit and stadia; (3) Hydrographic surveying and gauging of rivers; (4) Geodetic surveying; (5) Railway surveying. Text-books: Johnson's Theory and Practice of Surveying; Henck's Field Book for Engineers.

SECOND WINTER'S COURSE.

7. Civil engineering, seven weeks; military engineering, eight weeks; photography, five weeks; torpedoes, four weeks.

CIVIL ENGINEERING.

8. Subjects: (1) Improvement of nontidal rivers; (2) Improvement of tidal rivers; (3) Canals; (4) Building superintendence.

9. Text-books: Such parts of the following books as may be designated: Vernon Harcourt's Rivers and Canals; Schlichting's Improvement of Nontidal Rivers; Annual Reports of Chief of Engineers; Current Engineering Literature; Clark's Building Superintendence; Baker's Masonry Construction. Books of reference: (See third winter's course).

MILITARY ENGINEERING.

10. Subjects: (1) Modern guns, carriages, and projectiles; (2) Steel, compound, wrought, and cast-iron armor; (3) Modern ships of war and sea coast defenses; (4) Modern fortifications and their attack and defense.

11. Text-books: Such parts of the following books as may be designated by the academic staff: Woolwich Text-book of Fortifications; Maguire's Attack and Defense of Coast Fortifications; Fortifications of To-day; Inglis's paper in Professional Papers Royal Engineers, 1884, and a lecture on armored defense in Ordnance Notes No. 151; Very's Development of Armor; Naval Intelligence Papers, June, 1886; Adams's Spezia Experiments, 1886; Baylay's Types of Modern Guns; Abbot's Lectures on Seacoast Defense; Professional Papers No. X, of U. S. Engineer School of Application.

12. Books of reference: Articles on Fortifications and Gunnery, Encyclopædia Britannica; Ordnance Notes No. 135, and Appendix; Volume IX, Professional Papers Royal Engineers; Report of Board on Fortifications; McKinlay's Text-books on Gunnery; Brassey's Naval Annual, 1887.

MILITARY PHOTOGRAPHY.

13. Practice will be had in the following methods: Negatives by dry process; developers and intensifiers; silver printing and finishing and mounting of prints; map printing by the blue process and on bromide paper. Each officer to submit for examination two landscapes; negatives, silver and blue prints; two photographic copies; negatives, silver and blue prints; negative of map, with three blue and three bromide prints. Text-books: Griffin's Notes on Photography; von Sothen's The Development of the Latent Image on Gelatino-Bromide of Silver.

TORPEDOES.

14. One officer of the second winter's class will be detailed weekly to report to the instructor in torpedoes as assistant for testing core joints and instructing enlisted men on the torpedo detail.

THIRD WINTER'S COURSE.

15. Civil Engineering, eleven weeks; Military Engineering, eight weeks; Torpedoes, five weeks.

16. Civil Engineering. Subjects: (1) Wave and current action, and improvement of harbors; (2) Steam Engines and pumps; (3) Road-making; (4) Office methods.

17. Text-books: Such parts of the following books as may be designated: Harcourt's Harbors and Docks; Annual Reports, Chief of Engineers, U. S. Army; Current Engineering Literature; Roper's Engineers' Handy Book; Roper's Care and Management of the Steam Boiler; Pavements and Roads.

18. Books of reference: Trautwine's Engineers' Pocket Book; Bixby's Point de Grave; Whitham's Constructive Steam Engineering; Thurston's Manual of the Steam Engine; Ruffner's Improvement of Nontidal Rivers; Stevenson's Canal and River Engineering; Billings's Ventilation and Heating.

MILITARY ENGINEERING.

19. General Derrécagaix Modern War, and preparation of project for the defense of such place as may be designated by the instructor.

TORPEDOES.

20. One officer of the third winter's class will be detailed weekly to report to the instructor in torpedoes as assistant for the instruction of officers.

COURSE FOR ENLISTED MEN.

INSTRUCTION OF ENLISTED MEN IN TORPEDOES.

21. Instruction will comprise telegraphing with the dial instrument, including the code for action, and practice in the Morse system of telegraphy; the duties of the loading room, and, so far as practicable, of the boat service as prescribed in the Torpedo Manual, comprising preparing the plugs of the buoyant and ground torpedoes; charging the mines; charging the cut-off boxes, three methods; jointing the cores; making turk's heads on the electrical cable; using the junction boxes; attaching a cable stop; splicing and knotting hemp rope; inserting thimble in wire mooring rope. They will also receive from the instructor in torpedoes, or his assistant, lectures respecting the fuses, explosives, torpedo material (except that of the operating room), voltaic batteries, simple electrical testing, and the use of the portable apparatus for the electrical ignition of mines.

The "unit" detail for this instruction will consist of 1 non-commissioned officer and 4 privates. Six such details will report for duty Monday morning and will continue their instruction during fatigue hours, until their work has been inspected and accepted by the officer in immediate charge. One or two of the unit details will probably finish their tasks by Tuesday evening, when other details may be made to commence work Wednesday morning. As soon as a man has had his work accepted, *i. e.*, has received a rating of "2.5," he will be excused from further attendance, and in case he has shown a commendable amount of skill and intelligence in his duties he will be a candidate for such special privileges as it may be deemed expedient to give him. A soldier qualifying twice as "2.5" will be excused from further detail during the winter season.

Recruits on their first detail will be kept under instruction indefinitely until they have done each task at least twice, and have received a rating of at least "2.0." They will then be placed on the same footing as old soldiers for further details.

The officer in immediate charge will be present in the loading rooms a large portion of each day, frequently inspecting the work of the several details. He will make it a special object to note the character of instruction given by the noncommissioned officers who should know their duties well, and who should be held to a strict account for any defective work that their details may do. He will rate the men as they complete their tasks by a detailed examination of their finished work and a more or less detailed course of questioning. In determining a man's "mark" regard will be had to the degree of intelligence displayed as well as to the mechanical skill with which the work has been done. At the close of each week he will submit a "proficiency" report of the detail, and state what verbal or other instruction was given during the week.

INSTRUCTION OF ENLISTED MEN IN PHOTOGRAPHY.

22. Two noncommissioned officers will be detailed each week for instruction in photography. Practice will be had in the following methods: Negatives by dry process; developers and intensifiers; silver printing, and finishing and mounting of prints; map printing by blue process and on bromide paper.

II. The following assignment of instructors is made:

Torpedoes: Capt. W. L. Fisk, Corps of Engineers.

Military Engineering: Capt. R. L. Hoxie, Corps of Engineers.

Civil Engineering: Capt. W. M. Black, Corps of Engineers.

Military Photography: First Lieut. Henry Jervey, Corps of Engineers, battalion quartermaster.

By order of Lieut. Col. King:

ROBERT MCGREGOR,
Second Lieutenant of Engineers, Post Adjutant.

APPENDIX C.—PROGRAMME OF STUDY AND INSTRUCTION FOR SUMMER SEASON.

[Printed Orders No. 115.]

UNITED STATES ENGINEER SCHOOL,
Willets Point, New York Harbor, May 29, 1893.

The following programme of study and instruction for the ensuing summer season, to commence June 1, and end November 14, 1893 (24 weeks), having been recommended by the academic staff and approved by the Chief of Engineers, will be carried into effect.

A roster of the student officers will be kept by the post adjutant, who will make weekly details for the various duties so that they shall not conflict.

I. MILITARY ENGINEERING.

1. Practical instructions by the company officers in the nomenclature, dimensions, and construction of modern field and siege batteries and saps. Also practical instructions in the location of works on irregular ground and the adaptation to site.
2. A full course of trestle and ponton bridge drill.
3. Instruction in building spar bridges.
4. Instruction in military mining.
5. Military map making. Each lieutenant of engineers, who has not already done so; and such noncommissioned officers and privates as may be selected from each company, will make satisfactory foot reconnaissances about 4 miles long, in the vicinity of the post, the maps thereof to be submitted by company commanders to post headquarters on or before November 14, 1893.

II. TORPEDO DRILLS.

6. After receiving such preliminary practice as may be necessary to acquaint them with the practical details of preparing and planting a torpedo, the officers of the torpedo class will be divided into details of at least two officers each, for the purpose of taking charge of the preparation and planting of a grand group of torpedoes, under the direction of the instructor in torpedoes, assisted by one engineer officer of the second or third winter's class.
7. The senior officer will be in general charge, and will keep a daily journal of operations, noting particularly any difficulties encountered and any suggestions that may occur to him, looking to the avoidance of similar difficulties in the future.
8. The officers will frequently interchange duties so that each one shall have some experience in each part of the drill.
9. The electric light will be set up and operated.
10. The grand group being completed and the search light in position, the post commander will order an exhibition drill illustrating the operations of the torpedo defense against an attempted passage of the mine field by an enemy's vessel under cover of night.
11. The group will then be taken up by the same detail and the parts dismantled, cleaned, and conveniently grouped for the inspection of the instructor.
12. The detail will be instructed and exercised in automatic and judgment firing drills at such times as may be most convenient before the final exhibition drill.

13. The detail of enlisted men for each grand group drill will consist of 3 noncommissioned officers and about 12 privates.

14. The hours of work will be from 7 to 11:30 a. m., and from 1 to 4:30 p. m. In bad weather when no work is done and the men are in barracks, the latter will attend the same company duties and roll calls as daily duty men.

15. Weekly reports of progress will be rendered by the senior officer of the detail, and at the conclusion of the work, each officer will submit a report of the work done by him, mentioning difficulties encountered and any suggestions he may desire to make.

16. A detailed record will be kept of what each man does with the view of tracing out the author of defective work and determining the degree of proficiency developed by individual members of the detail. An account of the character of work done by each man will be submitted by the senior officer with his final report.

17. Occasionally, if practicable, loaded mines will be planted and fired as in actual service, height of jet, effect on neighboring mines and other phenomena being carefully observed and recorded.

18. At such times as will not interfere with the drills above mentioned, the officers of the class will make practical experiments in calibrating commercial ammeters and voltmeters, testing efficiency of dynamos and motors.

III. CIVIL ENGINEERING.

19. A topographical survey of about one-half square mile of ground by each officer of the first summer's class. Time allotted, five weeks.

20. A hydrographic survey of about one-quarter square mile by each officer of the second summer's class. Time allotted, four weeks.

21. While engaged in the field work in topographical and hydrographic surveys the officers will be assisted by details of enlisted men, and will be excused from all other duties.

IV. FIELD ASTRONOMY.

22. All the lieutenants of engineers who have not already completed the course, and been excused from further observations, will constitute the observers.

23. Officers wishing to use the instruments for special observations or practice must apply for authority to do so and are not permitted to handle any instruments unless specifically assigned to them by the instructor.

24. In case of damage to instruments or apparatus, it will be promptly reported to the instructor for the action of a board of survey.

25. The following will be the ordinary routine of observations with the several instruments, after reasonable proficiency has been attained by preliminary practice.

Sextant.—After becoming skillful in the use of this instrument upon the sun, observers will deduce at least one satisfactory latitude by observing a north and a south star, using the time deduced from an east and a west star—each based on ten altitudes taken on the same night. These observations for latitude and time must be made at the observatory. The observer may get "time" from an assistant using a portable chronometer and will determine, by comparison, the error of standard chronometer at observatory.

Chronograph.—Daily determination, by time signal from Washington, D. C., of error and rate of astronomical clock, by the officer of the day.

Transit.—A satisfactory set of time observations will be taken by each officer on two nights, successive if possible, determining satisfactorily the error of sidereal clock. The junior class will employ the eye and ear method; the senior class will use the chronograph.

Zenith telescope.—Observers will first determine the level correction by daylight, using a distant terrestrial object, or at night using a slow circumpolar star. They will then find the value of a turn of the micrometer by observing Polaris at elongation. Lastly they will observe for latitude, until they have obtained a satisfactory determination.

26. Suitable blank forms will be provided, both for observations and computations; and all problems must be submitted, complete in every detail, upon these forms. The original records after inspection by the commanding officer will be returned to the officers as their personal property.

27. Hours of attendance at the observatory will be, for both classes, daily except Saturday and Sunday, from 8 to 10 a m., from 2 to 4 p. m., and from 8 to 10 p. m. Evening hours will be extended when it is necessary to secure complete sets of observations.

V. MILITARY PHOTOGRAPHY.

28. The officers' laboratory will be opened daily from 1.30 p. m. to 4 p. m.

29. The building, apparatus, chemicals, etc., will be under the charge of the battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.

30. Officers are invited to avail themselves of the advantages of the laboratory, making such arrangements with the officer in charge as shall insure no confusion in his official duties, or in those of the men under his instruction.

31. The instruction of enlisted men will be restricted to a weekly detail of one noncommissioned officer from each company.

32. The battalion quartermaster will submit to this office weekly reports showing the nature of the instruction given, the results attained and the progress made.

By order of Lieut. Col. King:

ROBERT MCGREGOR,
Second Lieutenant of Engineers, Post Adjutant.

RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE AND NEW HAMPSHIRE.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Saint Croix River, Maine.
2. Lubec Channel, Maine.
3. Moosabec Bar, Maine.
4. Narraguagus River, Maine.
5. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.
6. Bagaduce River, Maine.
7. Penobscot River, Maine.
8. Belfast Harbor, Maine.
9. Camden Harbor, Maine.
10. Rockland Harbor, Maine.
11. Kennebec River, Maine.
12. Harraseeket River, Maine.
13. Portland Harbor, Maine.
14. Channel in Back Cove, Portland, Me.
15. Saco River, Maine.
16. Kennebunk River, Maine.
17. York Harbor, Maine.
18. Bellamy River, New Hampshire.
19. Cocheco River, New Hampshire.
20. Harbor of refuge at Little Harbor, N. H.
21. Removing sunken vessels or craft obstructing navigation.

EXAMINATIONS.

22. Channel near Hardys Point, below Pembroke, Me.
23. South Fork of Bagaduce River, Maine.
24. Vinal Haven, or Carver Harbor, Maine.
25. Lincolnville (Duck Trap) Harbor, Maine.
26. Frenchs Beach Harbor, Maine.
27. Rockland Harbor, Maine.
28. Owls Head Harbor, Maine.
29. Tennant Harbor, Maine.
30. Georges River, Maine.
31. Channel on south side of Portland Harbor, Maine.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 8, 1893.

GENERAL: I have the honor to forward herewith my annual report for the fiscal year 1893 on harbor and river works in my charge.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF ST. CROIX RIVER, MAINE.

The river and harbor act of August 11, 1888, provided for an examination and survey of the St. Croix River, the reports on which were published in Annual Report of the Chief of Engineers for 1890 (page 463).

When the survey was made the available depth over the shoals at mean low water was from 6.5 to 9.5 feet, and at the upper steamboat wharf at Calais it was but 1.5 feet. The channel was also narrow.

The improvement proposed was a channel 12 feet deep at mean low water, and generally 200 feet wide (but narrowed to 150 and 100 feet in the upper part of the harbor to avoid ledge) up to the upper steamboat wharf, immediately below the bridge, which marks the head of navigation.. Such improvement would enable steamboats to land at the upper wharf at all stages of the tide, and would also permit the larger vessels engaged in the lumber trade to receive their full cargoes at the wharves, instead of dropping down the river nearly 4 miles after being partially loaded, and completing their cargoes from material rafted down to them. The object was to be accomplished by dredging and by the construction of a small jetty and training wall. The work proposed extends over about 4 miles of the river. The difference between high and low tides is about 20 feet. The estimated cost of the improvement was $280,000.

The following appropriations have been made:

Act of—	
March 2, 1867	$15,000
March 3, 1873	10,000
June 23, 1874	10,000
March 3, 1881	4,000
September 19, 1890	35,000
	74,000

An examination of the river was made in 1867 by the officer in charge of the district, and subsequently appropriations were made for the improvement amounting to $35,000 in the aggregate, but the appropriation of 1867 provided that the Dominion Government of Canada should expend an equal amount on the improvement. In 1873 the Dominion Government of Canada appropriated $25,000 for improving the river, that being the amount that had been appropriated up to that time by the United States. A conference was held by the engineer of the district with an agent of the Dominion Government, and a plan of improvement was agreed upon. The obstructions consisted of slabs, sawdust, and other mill waste; but before allowing the expenditure of the money appropriated by the Government of Canada, the Minister of Public Works required that some guaranty should be given that the further deposit of this refuse in the river should be discontinued. As there did not seem to be any law at that time by which the deposit could be prevented, the money that had been appropriated was not expended on that improvement (with the exception of $1,000 for a survey of the river from the "ledge" to the head of navigation, made in 1873), and in 1879 Congress authorized the appropriations made for the St. Croix to be expended on Lubec Channel, which was done.

The appropriation of 1881 was for "Repairing breakwater on the St. Croix River near, Calais," and was expended for that purpose.

The act approved September 19, 1890, appropriated $35,000 for the

improvement of the St. Croix, "but upon condition that the Government of the Dominion of Canada shall expend a like sum in the improvement of said river." On account of the proviso contained in the act no expenditures have been made, and no work has been done under the appropriation of September 19, 1890, pending action by the Dominion Government.

Money statement.

July 1, 1892, balance unexpended	$35,000.00
July 1, 1893, balance unexpended	35,000.00
Amount (estimated) required for completion of existing project	245,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.	Articles.	1891.	1892.
	Tons.	*Tons.*		*Tons.*	*Tons.*
Bricks	500	1,000	Lime	5,000	4,000
Cement	1,000	800	Lumber	190,000	180,000
Coal	30,000	35,000	Plaster	15,000	16,000
Cotton	5,730	6,000	Plaster rock	17,000	17,000
Farm produce	10,000	10,000	Miscellaneous	100,000	100,000
Grain	10,000	12,000			
Flour	8,000	8,000	Total	393,230	391,300
Iron	1,000	1,500			

Number of vessels arriving and departing during calendar year 1893 (estimated).

Vessels of about 150 tons and upward, coastwise	900
Sloops and lighters, 100 tons and under, coastwise	450
Steamers and foreign cargoes	500
Total	1,850

A 2.

IMPROVEMENT OP LUBEC CHANNEL, MAINE.

This channel lies between the eastern extremity of the State of Maine and Campobello Island, Dominion of Canada. It has a length of between 2 and 3 miles, connecting the waters of Quoddy Roads below with those of Friar Roads above. The least width between low-water contours is about 400 feet and between high-water contours about 800 feet. The mean range of tides is about 17 feet. It affords a sheltered route, and the most direct one, for vessels to and from Eastport and the St. Croix River, besides being the only passage not in waters belonging to the province of New Brunswick. The channel is also important in connection with Quoddy Roads as a harbor of refuge.

During such storms as make anchorage in the latter unsafe vessels may escape through Lubec Channel into sheltered waters above.

The following appropriations have been made:

Act of—	
March 3, 1879	$44,000
June 14, 1880	20,000
March 3, 1881	45,000
August 2, 1882	20,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	20,000
	169,000

Previous to 1879 the mean low-water depth in the channel did not exceed 5 feet, and at extreme low-water the depth did not exceed 2 feet.

The project adopted in 1879 provided for a channel 200 feet wide and 12 feet deep at mean low tide, which would be equivalent to 9 feet at low spring tides. The estimated cost was $48,000.

This estimate was based on prices below what the work was subsequently done for. This project was revised in 1880, the estimated cost being increased to $130,000. The project was again, in 1884, amended so as to provide a channel 275 feet wide and 300 feet wide in the bends, the depth of 12 feet being retained, and the estimated cost of the entire project being increased to $171,500.

At the close of the fiscal year ending June 30, 1892, there had been expended the sum of $168,954.42. The project was completed.

The river and harbor act approved September 19, 1890, contained an order for an examination of Lubec Channel, the report on which was published in the Annual Report of the Chief of Engineers for 1891 (page 616). A new project is therein submitted for a channel having a least width of 500 feet and a depth of 12 feet at mean low water, the cost, in addition to the amount already expended, being estimated at $231,000.

No work was done during the year ending June 30, 1893. There were no expenditures during the past year.

There is a light-house on Campobello Island at the narrows, opposite Lubec. Lubec is in the collection district of Passamaquoddy.

Money statement.

July 1, 1892, balance unexpended	$45.58
July 1, 1893, balance unexpended	45.58

COMMERCIAL STATISTICS.

The commerce of Lubec Channel not being local in its character it is impracticable to obtain statements of the tonnage. The keeper of the Lubec Channel Light-Station has estimated that not less than 1,200 sailing vessels passed the station during 1891, besides a considerable number of steamers.

A 3.

IMPROVEMENT OF MOOSABEC BAR, MAINE.

Moosabec Bar is in the eastern part of Moosabec Reach, near Jonesport, Me. At mean low stages the depth was less than 6 feet, and at extreme low tides the depth was less than 4 feet. In fogs, which are prevalent on this part of the coast, navigation was rendered dangerous by the tortuous route that had to be taken to keep clear of the ledges.

A survey, ordered in the river and harbor act of March 3, 1879, was made by Col. George Thom and a project of improvement suggested, the estimated cost of which was $28,000. The project contemplated the excavation of a straight channel, running nearly east and west, 200 feet wide and 14 feet deep at mean low tide, and the removal of a sunken ledge near Steamboat Buoy to 15 feet. In 1881, after an appropriation had been made, the project was adopted, but the estimated cost was increased to $35,000. Subsequently, in 1882, the project was amended, as it was found that the quantity of dredging had to be increased, so that the cost as revised was estimated at $40,000. Work on that project was continued until 1888, when it was amended so as to provide for a channel 300 feet wide and 14 feet deep, the removal of certain ledges near the westerly end of the dredged channel to a depth of 16 feet, and the construction of a small breakwater to check cross currents. The estimated cost of the additional work was $110,000 and that for the entire improvement as enlarged $150,000. This latter project is the one now in process of execution.

The following appropriations have been made:

Act of—	
March 3, 1881	$10,000
August 2, 1882	10,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	15,000
September 19, 1890	15,000
July 13, 1892	15,000
	85,000

The expenditures to June 30, 1892, were $60,418.77.

At the latter date the 300-foot channel had been completed to the full projected width and depth, the breakwater had been built, and a small quantity of ledge had been removed.

The expenditures during the past year amount to $374.88.

Proposals for excavating ledge obstructing the western approach to the channel were opened December 3, and a contract was made December 23, 1892, with Johnston & Townsend, of Somers Point, New Jersey, at $13.35 per cubic yard, measured in place. The excavation is to be to the depth of 16 feet at mean low tide, and it is proposed to remove about 1,000 cubic yards under this contract.

Preparatory work was commenced in May, 1893, and work on the ledge about the first of June. At the close of the year the work was not sufficiently advanced to be of practical benefit.

The improvement is in the collection district of Machias, Me. The nearest lighthouse is Moose Peak. The nearest port of entry is Machias, Me.

Abstract of proposals for dredging in Narraguagus River, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (60,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	30	$18,000
2	Hamilton & Sawyer, Cumberland County, Me	33	19,800
3	Metropolitan Dredging Co., Lynn, Mass	27½	16,500
4	National Dredging Co., Wilmington, Del	29½	17,700

All bids rejected as being too high.

Abstract of proposals for dredging in Narraguagus River, Maine, November 16, 1892.

No.	Bidders.	Price per cubic yard (60,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	27½	$16,350
2	Charles H. Souther, Boston, Mass	34	20,400
3	Augustus B. Martin, Boston, Mass	35	21,000
4	Metropolitan Dredging Co., Lynn, Mass	27	16,200

All bids rejected as being too high.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Coal		1,200	2,000
Fish and salt		1,582	
Hides and leather	750	675	
Hay			300
Hardware and iron		200	1,500
Lumber	41,500	38,077	30,000
Miscellaneous	22,250	4,725	7,000
Stone and silica	2,000	2,500	4,500
Total	66,500	48,959	45,300

There arrived during the calendar year 1892: Steamers, coastwise, tonnage, 155,000; average draft, 8 feet. Sailing vessels, coastwise, tonnage, 12,500; average draft, 9 feet; vessels for refuge only, 250.

A 5.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, MAINE.

The anchorage in front of the town of Bar Harbor, Mount Desert Island, Maine, as well as the wharves at which steamers make their landings, is exposed to the seas from southerly and southeasterly directions. In southerly gales the anchorage is insecure in the harbor

proper, and the landing of passengers and freight at the wharves is said to be difficult at such times. The number of people that visit Bar Harbor in the summer is large, but the amount of freight delivered and shipped is comparatively small. The anchorage is used chiefly by yachts. There are neither factories nor quarries on this part of the island, and the trade is chiefly in supplies of all kinds for summer visitors.

The original project was the construction of a riprap breakwater from the westerly corner of Round Porcupine Island to Dry Ledge, and thence in a direct line to a point near the shore of Mount Desert Island. In December, 1890, it was proposed to slightly change the direction of the part of the breakwater west of Dry Ledge so that the westerly end would be somewhat farther to the southward.

In January, 1893, the project was again amended, and now provides for the construction of a breakwater on the direct line first proposed, but somewhat shorter, terminating at a distance of about 600 feet from the low-water line on Mount Desert Island, the structure to be built to the level of mean high tide, with slopes of 1 on 1, and a width of 20 feet on top throughout its entire length. This construction will, it is believed, answer all needful requirements at this locality, and at a total cost not much more than one-half that of the project of 1890.

The estimated cost of the project as it now stands is $420,200.

The following appropriations have been made:

By act of August 11, 1888	$50,000
By act of September 19, 1890	50,000
By act of July 13, 1892	50,000

The expenditures to June 30, 1892, amounted to $34,205.37. Up to the latter date the entire quantity of stone placed in the work amounted to 30,473 tons, all of which had been deposited in that part between Porcupine Island and Dry Ledge. The condition of the work was as follows:

About 385 linear feet of breakwater had been built up to high-water level and to the width of 20 feet on top, with slopes of 45 degrees on each face; about 80 feet more had been raised to high-water level but not to the full width, and about 130 feet more was about 7 feet above low water.

The expenditures during the past fiscal year were $19,330.55, making the total expenditures under the project, $53,535.92.

At the date of my last annual report operations were about to be commenced under two contracts, one with George M. Neelon for completing that part of the breakwater between Porcupine Island and Dry Ledge, the other with William S. White for work on that part between Dry Ledge and Mount Desert Island.

The contract with George M. Neelon was completed December 7, 1892, the contractor depositing 11,695 tons of stone in the work and completing the breakwater from Porcupine Island to Dry Ledge.

Under contract with William S. White the first stone was delivered August 4, 1892, though the contractor had been for some time at work opening a quarry on Porcupine Island, where he expected to procure nearly, if not all, the stone required under his agreement.

Up to the close of the fiscal year 9,921 tons of stone had been deposited under the latter contract in the part of the breakwater west of Dry Ledge. It is reported by masters of vessels that the work thus far done has been of great benefit to vessels making landings at Bar Harbor.

Bar Harbor is in the collection district of Frenchman Bay. The nearest port of entry is Ellsworth. The nearest light-house is on Egg Rock, 3¼ miles distant.

Money statement.

July 1, 1892, balance unexpended		$65,794.63
Amount appropriated by act approved July 13, 1892		50,000.00
		115,794.63
June 30, 1893, amount expended during fiscal year		19,330.55
July 1, 1893, balance unexpended		96,464.08
July 1, 1893, outstanding liabilities	$636.05	
July 1, 1893, amount covered by uncompleted contracts	46,639.50	
		47,275.55
July 1, 1893, balance available		49,188.53

Amount (estimated) required for completion of existing project 270,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of contracts for construction of breakwater from Mount Desert to Porcupine Island, Maine, in force during fiscal year ending June 30, 1893.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per ton for stone.
1	William S. White, Rockland, Me....	June 1, 1892	Breakwater west of Dry Ledge.....	$1.62
*2	George Mortimer Neelon, Greens Landing, Me.	June 8, 1892	Breakwater between Porcupine Island and Dry Ledge.	1.24½

* Contract completed.

COMMERCIAL STATISTICS.

It is reported that there is no material difference between the commercial statistics relating to Bar Harbor for the calendar year 1892 and those for last year. It is impracticable to obtain details, but the entire tonnage of the harbor for 1892 is reported as 34,044 tons. The number of passengers is reported as 115,561.

During the summer season the locality is much frequented by pleasure craft.

MODIFICATION OF APPROVED PROJECT FOR BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, MAINE.

UNITED STATES ENGINEER OFFICE,
Portland, Me., December 21, 1892.

GENERAL: The project for the construction of a breakwater from Mount Desert to Porcupine Island, Maine, was first approved January 14, 1889. The location adopted was a straight extension westward of the part to be built between Porcupine Island and Dry Ledge. The width on top, at the level of high tide, was to be 30 feet, with side slopes of 1 on 1 in rear and 1 on 1½ in front. The estimated cost, exclusive of a superstructure which was to be left for future consideration, was $497,840. The estimate was revised in the annual report for 1889, and is there given as $800,000, including the superstructure.

December 17, 1890, the project was modified, the location being changed by swinging the westerly end of that part west of Dry Ledge around to the southward, making it somewhat shorter, the width on top 20 feet instead of 30, and the slopes both inward and outward to 1

on 1; the width and slopes of the part between Porcupine Island and Dry Ledge remaining as first approved. The estimated cost was again revised in the annual report for 1891, and is there given as $806,000, exclusive of superstructure.

I have given the subject of this breakwater very careful consideration, and am of the opinion that one answering all needful requirements can be built on or near the site first selected for less money than it can be on the site last adopted.

It is not necessary, for instance, that the breakwater on either site should be so long. On the contrary, an opening of at least 600 feet between the end of it and the low-water line of Mount Desert Island is very desirable. An opening of less width would make the passage dangerous. Unless a good wide opening be left it were better to close it altogether by extending the structure to Mount Desert Island.

The exposure of the breakwater on either site is practically the same. Hence the same cross section would be required. The breakwater would not in one case require flatter slopes and greater width than in the other. To make a fair comparison as to cost the same cross section should, therefore, be adopted.

By leaving a passage of 600 feet between the end of the structure and the low-water line on Mount Desert Island the length of the breakwater on the old site will be 50 feet less than that on the new, and as the depth of water is on an average 6 feet less, the amount of material in the first will be less than that in the second.

The estimate of quantities and cost on the two sites is as follows:

First site, 382,000 tons of stone, at $1.10	$420,200
Second site, 489,500 tons of stone, at $1.10	538,450

The cost of the part between Porcupine Island and Dry Ledge is included in both the above estimates.

It is believed that slopes of 1 on 1 will not permanently stand, but as the exposure is not great it is probable that the structure may stand on steeper slopes than are ordinarily given to a breakwater. By building it with slopes of 1 on 1, those which it will naturally take under the action of the waves will be determined experimentally. When this shall have been done the final slopes can be made.

I have, therefore, to recommend that the project be modified as follows:

1. That the portion of it lying between Porcupine Island and Dry Ledge be built to the height of mean high tide, of rough quarry grout, with slopes of 1 on 1, and a width of 20 feet on top.

2. That the extension westward from Dry Ledge be in a direct prolongation of the part now built between Porcupine Island and Dry Ledge; that the breakwater be built of rough quarry grout, loosely thrown in, and terminate at a distance of 600 feet from the low-water line on Mount Desert Island; that the structure be built to the level of mean high tide, and have a width of 20 feet on top, with side slopes of 1 on 1.

There has only been 2,475 tons of stone delivered thus far in the extension west of Dry Ledge, most of which will be wasted if the project be modified. The part between Dry Ledge and Porcupine Island has been built to a width of 20 feet at mean high-tide level, with slopes of 1 on 1, and with the exception of a few tons to fill out in places it may be regarded as practically finished if the modification now suggested be approved.

I inclose a blue print,* in a separate roll, with the position of the

* Not printed.

breakwater indicated thereon, for both sites. The soundings are those taken by Mr. A. C. Both, assistant engineer.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 24, 1892.

Respectfully referred to the Board of Engineers, New York City, for consideration and report.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

THE BOARD OF ENGINEERS,
New York City, December 30, 1892.

Respectfully returned to the Chief of Engineers.

After careful consideration of these papers and other papers relating thereto contained in the printed reports of the Chief of Engineers for 1887 and 1891, the Board recommends that the modification in the approved project suggested by Col. Hains be approved, for economical reasons.

For the Board:

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
President of the Board.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 3, 1893.

Respectfully submitted to the Secretary of War.

Lieut. Col. Hains, the officer in charge of the work, recommends certain modifications of the approved project for the breakwater from Mount Desert to Porcupine Island, Maine, shown on the accompanying blue print.

Inviting attention to the indorsement hereon by the Board of Engineers, it is recommended that the modifications within proposed by Lieut. Col. Hains be approved.

Previous papers showing former action of the Secretary of War upon projects for this work are herewith.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT, *January 4, 1893.*

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN TWEEDALE,
Chief Clerk.

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

› Bagaduce is a small stream that empties into Penobscot Bay at
ne, Me. The upper part of the river divides into two branches,
alled Northern Bay and the other South Bay.
thern Bay, near South Penobscot, is a shoal sheet of water of about
res in area, the bottom of which for the greater part is bare at low
There is a narrow channel that runs from Bridges Point to Bow-
Wharf, which has a depth of less than 2 feet and is obstructed
lges near Winslows Island. The South Bay is obstructed by ledges
nsons Narrows.
roject for the improvement of the Northern Bay was adopted in
which has for its object the securing of a channel 100 feet wide
feet deep at mean low tide from Bridges Point to Bowdens
f, at an estimated cost of $45,000.
s also intended to remove a small quantity of rock obstructing the
Bay at Johnsons Narrows, at an estimated cost of $1,875.
› mean range of tides is about 9.5 feet.
› following appropriations have been made:

of August 11, 1888	$3,000
of September 19, 1890	4,000
of July 13, 1892	5,000

› expenditures to the close of the fiscal year ending June 30, 1892,
nted to $100, which were for preparation of plans, etc. No work
een done, the amount available at that date not being sufficient
omplish enough to be of any material benefit.
› expenditures during the year ending June 30, 1893, were $119.72,
ng the total expenditures $219.72.
ontract was made January 10, 1893, with Edgar P. Lovering, of
n, Mass., for dredging a channel 6 feet deep at mean low tide, and
t wide, from Bridges Point to Bowdens Wharf, removing all ma-
except ledge, the work to be done during the present season; the
act prices are 25 cents per cubic yard for dredging, and $3 per ton
moving bowlders weighing not less than 250 pounds each.

improvement is in the collection district of Castine. The nearest port of
is Castine, at the mouth of the river. The nearest light-house is at Dice
'

Money statement.

, 1892, balance unexpended	$6,900.00
nt appropriated by act approved July 13, 1892	5,000.00
	11,900.00
0, 1893, amount expended during fiscal year	119.72
, 1893, balance unexpended	11,780.28
, 1893, amount covered by uncompleted contracts	10,500.00
1893, balance available	1,280.28
unt (estimated) required for completion of existing project	34,875.00
unt that can be profitably expended in fiscal year ending June 30, 1895	25,000.00

nitted in compliance with requirements of sections 2 of river and
rbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for excavating a channel in Bagaduce River, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (3,000 cubic yards) situ.	Amount.
1	Moore & Wright, Portland, Me	$10.00	$30,000
2	Thomas Symonds, Leominster, Mass	6.00	18,000

All bids rejected as being too high.

Abstract of proposals for dredging in Bagaduce River, Maine, December 22, 1892.

No.	Bidders.	Mud, etc. (50,000 cubic yards).		Bowlders, price per ton.
		Price.	Amount.	
		Cents.		
1	Moore & Wright, Portland, Me	37	$18,500.00	$5.00
2	Robert Hamilton, Chebeague, Me	49	24,500.00	7.50
3	Edgar P. Lovering, South Boston, Mass	25	12,500.00	3.00

Contract made with Edgar P. Lovering, January 10, 1893.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.
	Tons.	*Tons.*
Bricks	6,000	7,500
Coal	2,200	2,350
Cotton	150	150
Farm produce	250	300
Fish	150	300
Grain	8,000	9,000
General merchandise	15,300	17,000
Ice	150	200
Lumber	2,800	3,500
Lime, cement, etc	300	400
Wood	6,000	5,400
Total	41,300	46,100

Most of the above is landed and shipped from Castine, at the mouth of the river.

A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

A survey of the Penobscot River was made in 1867 under the provisions of the act of Congress approved June 23, 1866. The navigation at that time was obstructed by rocks, ledges, and mill waste, giving at mean low tide only about 8 feet of water and a narrow, tortuous, and uncertain channel. At Bangor the depth was only about 6 feet at lowest stages, while numerous rocks and ledges made navigation danger-

ous. Col. Thom, under whose direction the survey was made, submitted an estimate for two projects of improvement, one giving a channel 150 feet wide and 12 feet deep at extreme low tide, up as far as Bangor, at an estimated cost of $125,000, and another with a depth of 18 feet at extreme low tide, at an estimated cost of $665,000.

The improvement of navigation was not undertaken, however, until 1870, when the first appropriation was made under the river and harbor act of that year. Work on the 12-foot project was then systematically undertaken and was continued until 1880, under the several appropriations made by Congress. The original project was amended several times during this period. This was rendered necessary by the discovery of shoals where before they were not known to exist, and by work being ordered by Congress which was not included in the original estimates. In 1876 the project was amended, so as to provide for a depth of 11 feet at extreme low tide, and as thus amended, it was completed in 1880. The expenditures up to that time amounted to $198,000, and had resulted in straightening, deepening, and widening the channel through the several shoals and bars at Bangor and for a distance of about 3½ miles downstream, giving it a width of 200 feet and a depth of not less than 11 feet at extreme low water, or 14 feet at mean low stages; also in breaking up and removing all the sunken ledges and bowlders in the harbor of Bangor, some outside the main channel, down to the level of the general bed of the river, including Independence Rock, Gulliver's Rock, ledge near the steamboat wharf, and those near Dole's Wharf, Green's Pier Ledge, and a ledge outside of it, the ledges and bowlders in front of the wharves at High Head, and also the removal of the shoal at Bucksport, known as the Middle Ground, on which there had formerly been only 4 feet of water at mean low tide.

No further work was done in the Penobscot River until 1883, when a new survey was made by Col. Blunt, under the provisions of the river and harbor act of 1882. Col. Blunt reported that the improvements made were satisfactory, as far as they went, but the increasing commerce of Bangor demanded additional facilities. He submitted a project for widening the channel at Bangor 100 feet, making it 300 feet wide, and for widening, straightening, and deepening the river near Crosbys Narrows at an estimated cost of $75,000. A project for this improvement was adopted in 1884 and work on it begun. While it was in progress the river and harbor act of 1886 called for another survey of the Penobscot River from Bangor to Bucksport Narrows. This survey was made in 1887, under the direction of Lieut. Col. Jared A. Smith, who submitted a project January 11, 1888, for improving the river from Winterport to Bucksport, at an estimated cost of $365,000. The project contemplated the securing of 22 feet at mean low tide between Bucksport and Winterport, by means of contraction works assisted by dredging. The estimated cost of the two projects combined was thus made $440,000, of which $85,000 had already, in 1888, been appropriated. The act of September 19, 1890, appropriated $25,000 and provided for dredging near Sterns Mill. This was no part of any of the projects submitted, but was ordered by Congress.

In the river and harbor act of September 19, 1890, Congress directed still another survey to be made of the Penobscot River, Maine. This was done by Lieut. Col. Jared A. Smith, Corps of Engineers, and a report was submitted which was published as House Ex. Doc. No. 37, Fifty-second Congress, first session. The works of improvement suggested in this report are to still further widen the channel at Bangor on the Brewer side 60 feet, making it 360 feet wide, keeping the same depth as before; to deepen the river between Winterport and Bucks-

port by the construction of jetties to 22 feet at mean low tide, and near Crosbys Narrows to 12 feet by the same means. The estimated cost of this last project is $202,000.

The general project under which the improvement of the Penobscot River is now being carried on may be stated as follows:

To widen the channel at Bangor to 360 feet and a depth of 11 feet at extreme low water; to widen, straighten, and deepen the channel near Crosbys Narrows and near Sterns Mill to a depth of 12 feet at extreme low tide, and to secure a channel depth of 22 feet at mean low tide between Bucksport and Winterport, the estimated cost of the entire work being $440,000, of which $150,000 has been already appropriated.

This estimate includes the cost of jetties at Frankfort Flats and High Head in order to contract the waterway should such contraction be necessary. It is thought, however, that as the deposit of sawdust and mill-waste into the river has, in a large measure, been stopped, and as the channels at these places were obstructed chiefly by this material, the contraction works may not be necessary. The channel at Frankfort Flats was dredged in 1890 to 22 feet, and while it has in some places filled in, there is still an available channel of that depth through it. The channel at High Head has deepened from natural causes, so that the available depth through it at the time of the last examination, about a year ago, had increased to about 21 feet. Under the circumstances it does not seem advisable to construct any contraction works, certainly not until it is definitely ascertained that such works are necessary.

Further examinations will be made of these channels.

For the present no additional appropriation is recommended for the Penobscot River.

The following appropriations have been made for the Penobscot River:

March 2, 1829 (for survey)	$300
July 11, 1870 (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 ($10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 ($4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 ($2,500 or so much thereof as necessary to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000
August 5, 1886 (for widening channel at Bangor and removing obstructions near Crosbys Narrows)	15,000
August 11, 1888 ($20,000 to be expended between Bangor and Crosbys Narrows, and $30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Stern's Mill	25,000
July 13, 1892	40,000
	348,300

The expenditures under the various projects up to the close of the fiscal year ending June 30, 1892, amounted to $284,332.87.

The results accomplished were the widening and deepening of the channel at Bangor from a depth of 6 feet at extreme low tide to 11 feet, for a width of 300 feet; the removal of rocks, ledges, and other obstructions; the removal of the shoal near Bucksport, and a general increase in depth and width of channels from the mouth up to Bangor.

The expenditures during the last fiscal year were $18,177.58, making
e total expenditures for the work, $302,510.45.
At the date of my last Annual Report a contract was in progress for
edging shoals at and near Stern's Mill. Dredging was continued
til November 15, 1892, when the contract was completed. The entire
antity of material removed was 61,460 cubic yards, scow measure-
nt, of which about 12,000 cubic yards were dredged during the fiscal
ar 1892. The contract price was 26½ cents per cubic yard. The ma-
ial was difficult to handle, consisting almost entirely of slabs and
gings, or sawmill waste.
Proposals for dredging were opened November 16, 1892, but, the
ices being high, all the bids were rejected. The work was readver-
ed, and a contract was made February 2, 1893, with Martin V. B.
ower, at 32 cents per cubic yard, scow measurement. Under this
ntract it is proposed to widen the channel at Bangor 60 feet, to the
pth of 11 feet at extreme low water, completing the channel to the
ll projected width. Work was commenced at the upper end of the
annel on the 7th of June, 1893, and by the close of the month about
00 cubic yards of material had been dredged.

Bangor, at the head of navigation, is a port of entry.

Money statement.

uly 1, 1892, balance unexpended		$23,967.13
mount appropriated by act approved July 13, 1892		40,000.00
		63,967.13
ne 30, 1893, amount expended during fiscal year		18,177.58
uly 1, 1893, balance unexpended		45,789.55
uly 1, 1893, outstanding liabilities	$300.00	
uly 1, 1893, amount covered by uncompleted contracts	14,720.00	
		15,020.00
uly 1, 1893, balance available		30,769.55
Amount (estimated) required for completion of existing project		290,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for dredging in Penobscot River, Maine, November 16, 1892.

Bidders.	Price per cubic yard (46,000 cubic yards) measured in scow.	Amount.
	Cents.	
Moore & Wright, Portland, Me	48	$22,080
Charles H. Souther, Boston, Mass	49	22,540
Augustus B. Martin, Boston, Mass	52	23,920
Metropolitan Dredging Company, Lynn, Mass	44	20,240

All bids rejected as being too high.

Abstract of proposals for dredging in Penobscot River, Maine, January 21, 1893.

No.	Bidders.	Price per cubic yard (46,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Martin V. B. Mower, Lynn, Mass	32	$14,720
2	Moore & Wright, Portland, Me	35	16,100

Alternative bids for hire of dredging plant to do this work were invited at the same time, but none were received.

Contract made with Martin V. B. Mower, February 2, 1893.

Abstract of contracts for dredging in Penobscot River, Maine, in force during the fiscal year ending June 30, 1893.

No	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard measured in scow.
*1	Andrew K. Stone, Boston, Mass	Nov. 14, 1891	Dredging shoal near Sterns Mill	$0.28½
2	Martin V. B. Mower, Lynn, Mass	Feb. 2, 1892	Dredging channel in Bangor Harbor.	.32

* Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Ashes		500	500
Bricks	17,000	8,575	3,206
Brimstone			500
Coal	147,260	104,113	115,009
Farm produce	27,290	2,025	2,000
Fish and oysters		107	200
Flour and grain	32,372	11,865	6,225
Fertilizer and plaster rock		1,400	2,000
General merchandise		51,333	52,209
Hay and wood		72,220	12,647
Iron, castings, etc	5,460	505	840
Ice	435,000	270,000	181,000
Lime and cement	3,394	568	4,350
Lumber	414,099	320,000	294,603
Last blocks			400
Molding sand and potters' clay			1,000
Miscellaneous	235,542	53,728	
Molasses and salt	2,039	1,841	2,701
Oil	3,010	2,500	3,094
Paving stone, granite, and slate	32,093	30,500	32,300
Total	1,354,559	931,780	714,935

Number of vessels arriving in calendar year 1892.

	No.	Tonnage.
Steamers, foreign, drawing 10 feet or more	2	2,279
Sailing vessels, foreign, drawing 10 feet or more	13	3,663
Steamers, coastwise, drawing 10 feet or more	785	289,592
Steamers, coastwise, drawing less than 10 feet	527	7,922
Sailing vessels, coastwise, drawing less than 10 feet	1,060	106,000
Sailing vessels, coastwise, drawing 10 feet or more	876	264,473
Barges, coastwise, drawing 10 feet or more	54	16,200

A 8.

IMPROVEMENT OF BELFAST HARBOR, MAINE.

Before the improvement was begun the harbor was not deep enough to accommodate the steamers and other vessels that visited the port.

Near Lane's Wharf there was a shoal on which the depth was only about 4 feet at mean low tide, but it deepened toward the mouth of the harbor.

A survey was made of the harbor in 1875 and a report submitted. As a result of the survey it was ascertained that to so improve the harbor as to afford a safe anchorage for shipping in all storms, and have a suitable depth for the several steamers and other vessels that touch and lie there in all stages of the tide, would require the removal of certain shoals and the construction of a breakwater or breakwaters at the entrance to the harbor. The estimated cost was $347,000. The dredging alone was estimated to cost $35,000. The latter was, in 1876, the project adopted. The construction of the breakwaters was abandoned.

The project contemplated dredging the lower part of the shoal to 12 feet at low tide between the channel and the wharf line as far up as the wharf of the Boston and Bangor line of steamers, and from thence between the channel and the wharf line up to near Lane's Wharf to 10 feet at low tide. That project was completed in 1879, at a cost of $22,000.

A new survey or examination of the harbor was ordered in the river and harbor act of August 11, 1888. This was made, and a new project adopted in 1890. The new project proposes to dredge a channel from the deep water at the entrance to the upper harbor 250 to 300 feet wide and 15 feet deep at mean low tide; to dredge an area 8 feet deep on the north side of the harbor, so that vessels of that draft can reach the wharf in front of Pierce's ice house and mills at low tide; to dredge an area on the south side of the channel to a depth of 13 feet at mean low tide, to accommodate vessels touching at the Boston and Bangor Steamboat Company's Wharf. The estimated cost of the new project is $52,000.

The following appropriations have been made:

Act of—	
August 14, 1876	$5,000
June 18, 1878	12,000
March 3, 1879	5,000
June 14, 1880	3,000
September 19, 1890	10,000
July 13, 1892	10,000
Total	45,000

The total expenditures on Belfast Harbor up to June 30, 1892, were $35,000. At the latter date the 8-foot dredging contemplated by the project had been completed, leaving the 13-foot and 15-foot dredging yet to be done.

The expenditures during the last fiscal year were $26.05.

Proposals for dredging the channel of entrance to a depth of 15 feet at mean low tide were opened October 3, 1892; and a contract was made, October 26, 1892, with Hamilton & Sawyer, of Chebeague, Me., at 23 cents per cubic yard, scow measurement. Work was commenced on the lower end of the channel June 6, 1893, and by the close of the fiscal year about 28,000 cubic yards had been dredged.

Belfast is in the collection district of Belfast. The nearest light-house is Dice Head, near Castine.

Money statement.

Amount appropriated by act approved July 13, 1892		$10,000.00
June 30, 1893, amount expended during fiscal year		26.05
July 1, 1893, balance unexpended		9,973.95
July 1, 1893, outstanding liabilities	$200.00	
July 1, 1893, amount covered by uncompleted contracts	9,200.00	
		9,400.00
July 1, 1893, balance available		573.95
Amount (estimated) required for completion of existing project		32,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		32,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867, and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging at Belfast Harbor, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (60,000 cubic yards).	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	24	$14,4[illegible]
2	Hamilton & Sawyer, Chebeague, Me	23	13,8[illegible]
3	Metropolitan Dredging Co., Lynn, Mass	26	15,6[illegible]
4	National Dredging Co., Wilmington, Del	24½	14,5[illegible]

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.	1892.
	Tons.	*Tons.*
Coal	10,710	10,8[illegible]
Farm produce	910	9[illegible]
Fertilizers	1,500	3,0[illegible]
Grain	5,029	5,0[illegible]
Hay	7,127	7,4[illegible]
General merchandise	20,112	21,2[illegible]
Lumber	3,400	2,9[illegible]
Ice	13,000	8,0[illegible]
Lime	1,325	1,4[illegible]
Stone	7,000	6,0[illegible]
Wood	980	8[illegible]
Total	71,093	67,5[illegible]

A 9.

IMPROVEMENT OF HARBOR AT CAMDEN, ME.

A survey was made of Camden Harbor in 1872 with a view to the improvement of its navigation, which prior to that time had been obstructed by the shoalness of the water over nearly all of its area, there being less than 12 inches depth over the most of it.

The first project was for regulating the entrance, by dredging, between the two principal steamboat wharves, which were located on opposite sides of the entrance; dredging a channel about 1,500 feet long, 100 feet wide, and 7 feet deep at mean low tide from the entrance to the head of the wharves on the easterly side of the harbor, and a channel 1,400 feet long, of the same width and depth, extending up to the head of the wharves on the westerly side of the harbor. The total excavation required was about 90,000 cubic yards and the estimated cost $33,000. The total amount actually expended on the project was $33,000, and with the expenditure of this amount the project was completed in 1876.

In the harbor and river act of 1886 a new survey of Camden Harbor was ordered. This was made in 1887, and a project submitted for further improvement of the harbor. The dredged channels which had been made under prior appropriations, though they had not filled up to any appreciable extent, were not deep and wide enough to accommodate the increasing commerce. The new project contemplates: (1) The dredging of an area at the entrance to the harbor, and near the Boston Steamboat Wharf, to a depth of 12 feet at mean low tide; (2) the dredging of an area at the entrance, so as to afford more easy access to the harbor, to a depth of 10 feet at mean low tide; (3) the dredging of a channel along the wharf line on the west side of the harbor as far up as Aldens Wharf to a depth of 10 feet, and from thence up to the Anchor Factory and to Derow's shipyard to a depth of 5 feet at mean low water; (4) the dredging of a channel on the east side nearly up to Keys Wharf to a depth of 10 feet, and from thence up to Dailey's shipyard to a depth of 5 feet at mean low tide. These channels to be about 50 feet wide at the upper end, where the depth is to be 5 feet, and about 100 feet wide where the depth is to be 10 feet.

The removal of the middle ground—that is, the space between the two channels—though desirable, was not regarded as an essential part of the project, and was not to be undertaken until the other parts had been completed. Subsequently its removal was included in the project. The estimated cost of the entire work was $60,000.

The following appropriations have been made:

Act of—	
March 3, 1873	$10,000
June 23, 1874	10,000
August 11, 1888	5,000
September 19, 1890	6,000
July 13, 1892	12,000
Total	43,000

The expenditure of the first two appropriations resulted in giving a good entrance to the harbor, and two channels, one on each side along the lines of wharves, not less than 6 feet deep at mean low tide.

The total expenditures up to the close of the fiscal year ending June 30, 1892, inclusive of both projects, amounted to $31,000. As a result the western channel had been dredged to a depth of 10 feet at mean

low tide throughout its entire length, including the approach, the latter to a width of 125 feet and the channel itself to a width of 100 feet.

The expenditures during the last fiscal year were $41.93. No work was in progress.

Proposals for dredging were opened October 3, 1892, but the prices being considered high, all bids were rejected, and the work was readvertised. Bids were opened again November 16, 1892, and a contract was made December 17, 1892, with Hamilton & Sawyer, of Chebeague, Me., at 25¾ cents per cubic yard, scow measurement. The work is to be commenced October 1, 1893.

Camden is in the collection district of Belfast. The nearest light-house is on Negro Island, at entrance to harbor.

Money statement.

Amount appropriated by act approved July 13, 1892	$12,000.00
June 30, 1893, amount expended during fiscal year	41.93
July 1, 1893, balance unexpended	11,958.07
July 1, 1893, amount covered by uncompleted contracts	11,000.00
July 1, 1893, balance available	958.07
Amount (estimated) required for completion of existing project	37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	37,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Camden Harbor, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (60,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	29	$17,400
2	Hamilton & Sawyer, Cumberland County, Me	28	16,800
3	Metropolitan Dredging Co., Lynn, Mass	31	18,600
4	National Dredging Co., Wilmington, Del	30	18,000

All bids rejected as being too high.

Abstract of proposals for dredging in Camden Harbor, Maine, November 16, 1892.

No.	Bidders.	Price per cubic yard (60,000 cubic yards), measured in scow.	Amount.
		Cents.	
1	Hamilton & Sawyer, Chebeague, Me	25¾	$15,450
2	Moore & Wright, Portland, Me	26	15,600
3	Charles H. Souther, Boston, Mass	36	21,600
4	Augustus B. Martin, Boston, Mass	32	19,200
5	Metropolitan Dredging Co., Lynn, Mass	27½	16,500

Contract made with Hamilton & Sawyer, December 17, 1892.

COMMERCIAL STATISTICS.

The receipts and shipments for the calendar year 1891 were reported as 45,575 tons. It has been impracticable to obtain statistics for the year 1892, but it is thought the tonnage did not materially differ from that reported for 1891.

A 10.

IMPROVEMENT OF HARBOR AT ROCKLAND, ME.

The location of Rockland Harbor is such that, besides accommodating its own commerce, it affords a convenient refuge for large numbers of coasting vessels. When the project for a breakwater was adopted the harbor was open to easterly storms, the anchorage was unsafe, and the seas often broke over the wharves.

The following appropriations have been made for the improvement of Rockland Harbor:

Act of—	
June 14, 1880	$20,000
August 2, 1882	40,000
July 5, 1884	40,000
August 5, 1886	22,500
August 11, 1888	30,000
September 19, 1890	37,500
July 13, 1892	30,000
Total	220,000

The project as originally adopted in 1881 provided for two breakwaters, one starting from Southwest Ledge, in the harbor, and running in a northerly direction toward Jameson Point, a distance of 2,640 feet, the other starting from Jameson Point, and extending southward about 1,900 feet. The estimated cost was $550,000. The top of each breakwater was to be only 5 feet above the level of mean low tide.

In 1887 the project was amended so as to bring the top of the breakwater from Jameson Point to the level of high tide, leaving the other as originally designed. The estimated cost was thus increased to $650,000.

In 1890 the project was again modified. Instead of building the second breakwater from Southwest Ledge in a northerly direction, on which no work had been done, it was decided to prolong the one from Jameson Point in a southerly direction. By doing so a much larger area of the harbor would secure protection.

The estimated cost of the new project was $632,500, this being inclusive of the cost of the part already constructed.

Up to the close of the fiscal year ending June 30, 1892, there had been expended on the breakwater the sum of $169,385.48, and about 180,000 tons of stone had been placed in position. The above expenditures had resulted in protecting a part of the harbor, giving a secure harbor of refuge for many vessels that trade near this port.

During the fiscal year ending June 30, 1893, there has been expended the sum of $29,750.97.

At the date of my last annual report work was in progress under a contract with William S. White, of Rockland, Me. Operations were continued until early in November, when the contract was completed. Forty-two thousand nine hundred and twenty-four tons of stone in all

were delivered by Mr. White, the price being 78½ cents per ton. At the date of the completion of this contract the breakwater had been practically completed to a point about 2,215 feet from the shore.

Proposals for extending the breakwater under the appropriation of 1892 were opened November 22, 1892. Mr. White was again the lowest bidder, his price being 73 cents per ton, and a contract was made December 1, 1892. At the close of the fiscal year 1893, about 23,460 tons of stone had been deposited under this latter contract.

Money statement.

July 1, 1892, balance unexpended		$20,614.52
Amount appropriated by act approved July 13, 1892		30,000.00
		50,614.52
June 30, 1893, amount expended during fiscal year		29,750.97
July 1, 1893, balance unexpended		20,863.55
July 1, 1893, outstanding liabilities	$1,330.91	
July 1, 1893, amount covered by uncompleted contracts	15,240.94	
		16,571.85
July 1, 1893, balance available		4,291.70
Amount (estimated) required for completion of existing project		412,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for extension of breakwater in Rockland Harbor, Maine, November 22, 1892.

No.	Bidders.	Price per ton (35,000 tons stone).	Amount.
		Cents.	
1	Chas. F. Williams, Rockland, Me	77	$26,950
2	William P. Hurley, Rockland, Me	78	27,300
3	John F. Hamilton, Portland, Me	74	25,900
4	William S. White, Rockland, Me	73	25,550
5	Joseph F. Curit, Chebeague, Me	74½	26,075

Contract made with William S. White, December 1, 1892.

Abstract of contracts for construction of breakwater in harbor at Rockland, Me., in force during the fiscal year ending June 30, 1893.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per ton for stone.
*1	William S. White, Rockland, Me	Dec. 13, 1890	Extension of breakwater	$0.78½
2	do	Dec. 1, 1892	do	.77

* Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Brick, cement, and sand	3,709	3,897	42,904
Coal	31,205	33,505	42,480
Fish and salt, etc	2,306	2,569	8,257
Grain and flour	5,084	6,147	9,620
General merchandise	64,318	67,579	28,100
Hay and straw			413
Lumber and shiptimbers	23,234	24,376	27,680
Lime	150,000	160,000	97,785
Oil			538
Stone	54,200	54,778	74,397
Sawdust and ashes			6,071
Steel rails, iron work, and castings			2,172
Wood and cooperage	71,950	76,237	188,388
Ice	5,500	4,672	
Total	411,566	433,760	528,805

Number of vessels arriving in calendar year 1892.

Steamers, coastwise:	
400 to 1,400 tons each	529
50 to 400 tons each	2,000
Sailing vessels:	
foreign, average 85 tons each	729
coastwise trade	4,185
for refuge only	1,200

A 11.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

Congress recognized the importance of improving the Kennebec River as early as 1827, when an appropriation was first made. Appropriations aggregating $18,500 were made between 1827 and 1852. From 1852 to 1866 no work was done by the General Government, but the citizens of Augusta within this period undertook to dredge out a channel above Sheppard's Point, and they improved it in some localities, but the material was not removed a sufficient distance from the channel, and from that and other causes it filled up again.

The act of June 23, 1866, appropriated $20,000 for the improvement of the upper part of the river, between Sheppard's Point and Augusta, a length of about 3 miles. The project for this improvement consisted in removing rocks and straightening and deepening the channel, which was obstructed by shoals, to a depth of 8 feet up to Hallowell and 7 feet from thence to Augusta. The estimated cost was $50,000. The projected width of channel was fixed at first at 75 feet.

In 1866, after a survey of the river had been made from Augusta to Gardiner, the project was amended so as to include all that part of the river from Gardiner to Augusta, and the width fixed at 100 feet. The amended project was estimated to cost $80,000. In 1871 the project was again extended by act of Congress, which appropriated $5,000 for improving the river between Gardiner and Richmond. This part of the river it was proposed to improve so as to give 10 feet at low tide

up to Gardiner. This necessitated the removal of a ledge near Nehumkeg Island, of ledges and boulders at other points, the dredging of a channel through the Upper Sands Bar, and one near the head of Swan Island.

The estimated cost of this additional project was about $13,000.

By July 1, 1872, all the work contemplated in the various projects for improving the Kennebec from Richmond up to Gardiner had been completed. There were, however, several rocks in the main channel of the river at Lovejoy Narrows, on the east side of Swan Island, which were a source of danger to shipping. One of them, known as "Half-tide Rock," had been excavated to a depth of 8 feet at low tide, but as this gave only about 13 feet at high tide it was not sufficient to accommodate commerce. In the report of the Chief of Engineers for 1872 the removal of some of these rocks to a depth of 12 feet at mean low tide was suggested, at an estimated cost of $13,500. A survey of two of the ledges was made in 1872, when it was found they were larger than was expected, so that the estimate was increased to $30,603.61. A more accurate survey was made in 1874, and other small sunken ledges were found. In that year the adopted project consisted in removing Ledges III, IV, V, and Dry Rock, all to a depth of 12 feet at mean low tide. Ledge I (Half-tide Rock) had been completed to 12 feet in November, 1873, and Ledge II was omitted from the project, as the removal of Dry Rock seemed to render the removal of Ledge II unnecessary.

In 1877 all the dangerous rocks in Lovejoy Narrows had been removed to a depth of 12 feet at mean low tide, which completed all projected improvements in the Kennebec River.

No further work was done on the river until 1880, when a survey was made in obedience to the requirement of the harbor and river act of June 14, 1880, of Richmond Harbor, at the head of Swan Island, with a view to its improvement. The project suggested for this improvement, which was adopted in 1881, was to give a navigable channel not less than 10 feet deep at mean low water on the shoals at the upper end of Swan Island and at Hatch's Rock, about 2 miles below, and 11 feet at the lower end of Swan Island, about 5 miles below the town of Richmond.

The estimated cost of the project was $20,500. This project was completed in 1883.

In the river and harbor act of 1886 a new survey of the Kennebec River was ordered at Bath, and from Augusta to the lower end of Perkins Island. This survey was made in 1887, and a new project for the improvement of the river from Bath to Augusta was submitted. The project submitted consists in removing the shoals at Beef Rock, at Hatchs Rock, and near South Gardiner by means of wing dams and training walls, and dredging, the removal of rocks at Bath and at Lovejoy Narrows by blasting, and the dredging of a channel through the shoals between Augusta and Gardiner, and the removal of the old piers of the bridge at Hallowell. The depths were to be as follows: At Beef Rock Shoal 12 feet, at Hatchs Rock 9 feet, at Lovejoy Narrows 18 feet, at Upper Sands Bar 12 feet, at Hallowell Shoal 10 feet, and from thence to Augusta 8 feet, all at low tide.

The estimated cost of the entire project was $410,500. In 1888, an appropriation of $75,000 having been made for the improvement of the Kennebec River, a project for the expenditure of the appropriation in improving Hatchs Rock and Beef Rock Shoals was approved. Subsequently owing to dredging which had to be done, and which was not

contemplated in the original project, the estimated cost of the entire improvement was increased to $428,500. All of the appropriation made by act of September 19, 1890, was also expended on Beef Rock and Hatchs Rock Shoals and the removal of the piers of the old bridge at Hallowell.

In August, 1892, the project was revised, and a general project for the improvement adopted, as follows: For a channel depth of 13 feet up as far as Sands Island; 12 feet from thence to Hinckleys Shoal; and 10 feet from thence to Augusta; a steamboat channel, 9 feet deep, west of Swan Island, and the removal of old bridge piers at Hallowell, all the above depths being referred to mean low tide. The estimated cost of the revised project is $388,500.

The aim of the project is to be accomplished by dredging and contraction works at Beef Rock Shoal, Hatchs Rock Shoal and Upper Sands Bar; dredging alone between Gardiner and Augusta; and rock excavation at Lovejoy Narrows.

The following appropriations have been made;

March 2, 1827	$4,000	March 3, 1873	$12,000
March 19, 1828	3,500	June 23, 1874	12,000
April 23, 1830	5,000	March 3, 1875	15,000
August 30, 1852	6,000	March 3, 1881	10,000
June 23, 1866	20,000	August 11, 1888	75,000
March 2, 1867	30,000	September 19, 1890	50,000
April 10, 1869	14,850	July 13, 1892	100,000
July 11, 1870	15,000		
March 3, 1871	15,000	Total	395,350
June 10, 1872	8,000		

The total expenditures on the river up to June 30, 1892, were $288,792.82. The results accomplished may be stated thus:

Before the improvements were commenced the main channel between the foot of Swan Island and Gardiner (15 miles) was obstructed by a shoal at the foot of Swan Island with only 10 feet on it at mean low tide, by dangerous ledges in Lovejoy Narrows, by a shoal below South Gardiner with only 8 feet of water on it at mean low tide, and by a ledge in the channel at Nehumkeg Island. This part of the river has been improved by dredging, contraction works, and removal of ledge, so as to give a good channel 12 feet deep at mean low tide as far up as Gardiner, except over the shoal below South Gardiner. A channel was dredged through this shoal to a depth of 10 feet at mean low tide, but gradual filling has since reduced this depth to 9 feet.

The steamboat channel to the westward of Swan Island has been improved by dredging and contraction works so as to give a depth of 9 feet at mean low tide. The former depth over the shoals was but 7½ feet.

The channel between Gardiner and Augusta (6½ miles) was obstructed by shoals with a depth of water on them of only 3½ feet at low summer tide. This depth was increased by dredging to 7 feet between Gardiner and Hallowell, and 6½ feet between Hallowell and Augusta. Gradual shoaling has since reduced the available channel depth to 6 feet between Gardiner and Hallowell, and to 5 feet between Hallowell and Augusta. Three old bridge piers were also removed from the channel of the river at Hallowell. Low summer tide line is about 2 feet below that of mean low tide.

The expenditures during the year ending June 30, 1893, have been $21,415.57.

At the date of my last annual report a contract with Moore & Wright of Portland, Me., for redredging the channel at Beef Rock was ap-

proaching completion. The work was finished July 15, 1892, giving a channel about 150 feet wide, and 14 feet deep at mean low tide. The entire quantity dredged under this contract was 39,234 cubic yards, and the price 17½ cents per cubic yard.

By the river and harbor act of 1892, $100,000 were appropriated for continuing the improvement, with a provision that a sum not exceeding $5,000 may, in the discretion of the Secretary of War, be expended between the cities of Augusta and Waterville. A survey of the part of the river referred to (which is above that portion covered by the existing project) was made in 1891, and the report printed in the Annual Report of the Chief of Engineers for 1892 (pp. 541–550). The amount was too small to accomplish any material benefit, besides which there exists at Augusta a dam, the property of a private corporation, with a lock through which vessels must pass to reach the upper river. This lock should become the property of the United States before the improvement of the river above it is undertaken by the National Government. The amount ($5,000) made available by the act of 1892 is held for future allotment.

Proposals were opened October 3, 1892, for the construction of the jetty at Upper Sands Bar. The lowest bid was $1.27 per ton of 2,000 pounds of stone placed in the jetty. This price being considered high all the bids were rejected. Early in January, 1893, the construction of the jetty was commenced by hired labor and purchase of material in open market, and by the 9th of the following month the work was completed, 11,939.6 tons of stone having been put in place. The jetty is about 1,500 feet long and 10 feet wide on top, the latter being at level of high tide.

The material was hauled in sled teams to the river and out on the ice, which ranged from 12 to 18 inches in thickness. Sixty-five cents per ton of 2,000 pounds was paid for the stone placed in the work.

Proposals for completing the jetty at Beef Rock Shoal were opened at the same time as for the jetty at Upper Sands Bar. The lowest bid was $1.09 per ton. All the proposals were rejected, as it was believed that the work could be done for less, and the work was undertaken by hired labor and purchase of material in open market, in the manner adopted at Upper Sands Bar. The conditions were not so favorable as at Upper Sands, as the ice had jammed to a considerable thickness on the line of the partly completed work. During February and March, 1893, 6,485 tons of stone, for which 85 cents per ton was paid, were placed in position, closing a gap near the upper end of the jetty. This was all that could be done to advantage while the river was frozen over, and work was suspended. In the meantime a considerable quantity of material was collected on the adjacent shore, and about the 1st of June, 1893, operations were resumed, the material being conveyed to the jetty in flatboats. At the close of the fiscal year about 2,170 tons had been deposited in this way.

Proposals for dredging at Upper Sands Bar were opened October 3, 1892, but all the bids were rejected as being too high; the lowest was 31 cents per cubic yard. The work was offered again, with other dredging, and the bids opened November 16, 1892. A contract was made December 19, 1892, with Moore & Wright, of Portland, Me., for dredging at Upper Sands Bar, at 28 cents per cubic yard and at shoals near Gardiner, at 40 cents per cubic yard. Work under this contract was commenced June 12, 1893, and by the close of the month a small shoal below the bridge, and a larger one immediately above the bridge at Gardiner, had been dredged to a depth of 12 feet at mean low tide.

ember 22, 1892, proposals were opened for removing ledge in y Narrows. The lowest bid was $13 per cubic yard, but was not . The work was readvertised, and the bids were opened Janu-, 1893. A contract was made February 7, 1893, with Townsend n, of Boston, Mass., at $12.47 per cubic yard. The contractors ished a platform from which to drill and blast, during the early f June, 1893, and by the close of the month had accomplished a amount of excavation over the ledge known as Rock No. 1, or ide Rock.

mprovement is in the collection district of Bath, of which Bath is the port of Fort Popham and the light-house on Pond Island are near the month of the

Money statement.

1892, balance unexpended		$6,557.18
; appropriated by act approved July 13, 1892		100,000.00
		106,557.18
, 1893, amount expended during fiscal year		21,415.57
1893, balance unexpended		85,141.61
1893, outstanding liabilities	$2,509.50	
1893, amount covered by uncompleted contracts	66,118.42	
		68,627.92
1893, balance available		16,513.69
nt (estimated) required for completion of existing project		163,500.00
nt that can be profitably expended in fiscal year ending June 30, 1895		100,000.00

itted in compliance with requirements of sections 2 of river and bor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

of proposals for dredging at Upper Sands Bar, Kennebec River, Maine, October 3, 1892.

Bidders.	Price per cubic yard (45,000 cubic yards).	Amount.
	Cents.	
rles H. Souther, Boston, Mass	45	$20,250
ropolitan Dredging Co., Lynn, Mass	35	15,750
re & Wright, Portland, Me	31	13,950

ds rejected as being too high.

of proposals for construction of riprap jetty at Upper Sands Bar, Kennebec River, Maine, October 3, 1892.

Bidders.	Price per ton (15,000 tons stone).	Amount.
a F. Hamilton, Portland, Me	$1.30	$19,500
lan & Carlton, Bath, Me	1.27	19,050

ds rejected as being too high.

Abstract of proposals for completion of riprap jetty at Beef Rock Shoal, Kennebec River, Maine, October 3, 1892.

No.	Bidders.	Price per ton (10,000 tons stone).	Amount.
1	Jordan & Carlton, Bath, Me	$1.15	$11,500
2	Seth D. Houdlette, South Dresden, Me	1.24	12,400
3	George Newel, Richmond, Me	1.24	12,400
4	Charles F. Wads, Richmond, Me	1.10	11,000
5	John F. Hamilton, Portland, Me	1.09	10,900

All bids rejected as being too high.

Abstract of proposals for dredging in Kennebec River, Maine, November 16, 1892.

No.	Bidders.	Upper Sands Bar. Price per cubic yard (45,000 cubic yards).	At and above Gardiner. Price per cubic yard (75,000 cubic yards).	Amount.
		Cents.	*Cents.*	
1	Charles H. Souther, Boston, Mass	34	49	$52,050
2	Metropolitan Dredging Co., Lynn, Mass	34	55	56,550
3	Augustus B. Martin, Boston, Mass	39	50	55,050
4	Moore & Wright, Portland, Me	28	40	42,000

Contract made with Moore & Wright, December 19, 1892.

Abstract of proposals for removing ledge in Lovejoy Narrows, Kennebec River, Maine, December 22, 1892.

No.	Bidders.	Price per cubic yard (1,886 cubic yards) in place.	Amount.
1	(Not signed)	$13.00	$24,518.00
2	Johnston & Townsend, Somers Point, N. J	26.25	49,500.10
3	Townsend & Olsen, Boston, Mass	16.47	31,062.42
4	Edgar P. Lovering, South Boston, Mass	16.90	31,873.40

No. 1 bid rejected for informality, and the remaining bids as being too high.

Abstract of proposals for removing ledge in Lovejoy Narrows, Kennebec River, Maine, January 21, 1893.

No.	Bidders.	Price per cubic yard (1,886 cubic yards) in place.	Amount.
1	Townsend & Olsen, Boston, Mass	$12.47	$23,518.42
2	Thomas Symonds, Wilmington, Del	14.00	26,404.00

Contract made with Townsend & Olsen, February 7, 1893.

tracts of contracts for improving Kennebec River, Maine, in force during the fiscal year ending June 30, 1893.

Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.
Moore & Wright, Portland, Me	Apr. 19, 1892	Dredging Beef Rock Shoal	†$0.17½
.....do	Dec. 19, 1892	Dredging at Upper Sands Bar	†.28
		Dredging shoals at and above Gardiner.	†.40
Townsend & Olsen, Boston, Mass..	Feb. 7, 1893	Removal of ledges at Lovejoy Narrows.	‡12.47

* Contract completed. † In scow. ‡ In place.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
ks		1,903	13,500
		123,356	150,000
ent and plaster		335	532
n		150	195
ral merchandise		22,400	33,000
ifte		12,000	12,000
	8,500	13,255	16,500
	1,000,000	846,165	925,000
		830	465
		245	
ber and ship timbers	201,894	186,523	111,953
		2,212	
l		1,100	
Total	1,210,394	1,210,474	1,263,145

Number of vessels arriving in calendar year 1892.

mers, coastwise:	
About 1,600 tons each	424
100 tons or less each	756
ng vessels:	
Coastwise, average 400 tons each	3,600
Foreign, average 400 tons each	166
	4,946
s (steam) plying in the river	17
m ferryboats in the river	2
sels built during the year, gross tonnage 13,086	18

A 12.

IMPROVEMENT OF HARRASEEKET RIVER, MAINE.

The act approved March 3, 1881, provided that a survey be made of s river. The survey was made in July of that year, and a report s submitted in December by the engineer of the district.

The river empties into Casco Bay at Stocksbridges Point, about 12 les northeast of Portland. From Stocksbridges Point up to Wesns Point the depth of water is no less than 10 feet at mean low tide, ith no obstructions to navigation. From Westons Point up to Free-

port Landing, a distance of 4,500 feet, the depth diminishes so that for the greater part of the distance the bottom of the river is 3½ feet out of water at mean low tide. The rise and fall of tides here is 9 feet. The project recommended in 1881 was the dredging of a channel not less than 60 feet wide and 3 feet deep at mean low tide up to Freeport, and a turning basin 180 feet wide at the head of the channel. The estimated cost of the improvement recommended was $13,000.

No appropriation was made for the work, however, and a new survey was ordered in the river and harbor act of 1888. A project for the improvement was submitted January 4, 1889. This project was on a somewhat larger scale than the one previously suggested, and contemplated a depth of channel of 5 feet at mean low tide, which would give about 14 feet at high tide.

The estimated cost of the project was $36,000.

The following appropriations have been made:

Act of September 19, 1890	$10,000
Act of July 13, 1892	16,000

The appropriation of 1892 is for completing the improvement.

No work had been done up to the close of the fiscal year ending June 30, 1892, as it was not deemed expedient to expend any money on it until sufficient funds had been appropriated to accomplish some good results, which could not be done with the amount of the first appropriation alone.

The expenditures during the fiscal year ending June 30, 1893, were $47.80. No work was done. Proposals for doing the work were opened October 3, 1892, and again November 16, 1892, but in each case the prices were considered high and all the bids were rejected. The work will be readvertised at an early date.

The river is in the collection district of Portland and Falmouth. The nearest light-house is on Halfway Rock.

Money statement.

July 1, 1892, balance unexpended		$10,000.00
Amount appropriated by act approved July 13, 1892		16,000.00
		26,000.00
June 30, 1893, amount expended during fiscal year		47.80
July 1, 1893, balance unexpended		25,952.20

Abstract of proposals for dredging in Harraseeket River, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (150,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	29	$43,500
2	Hamilton & Sawyer, Cumberland County, Me	31	46,500
3	Metropolitan Dredging Co., Lynn, Mass	35	52,500
4	Augustus B. Martin, Boston, Mass	34	51,000
5	Charles H. Souther, Boston, Mass	41	61,500
6	National Dredging Co., Wilmington, Del	32	48,000

All bids rejected as being too high.

Abstract of proposals for dredging in Harraseeket River, Maine, November 16, 1892.

Bidders.	Price per cubic yard (150,000 cubic yards) measured in scow.	Amount.
	Cents.	
Hamilton & Sawyer, Chebeague, Me	28½	$42,750
Charles H. Souther, Boston, Mass	28	42,000
Metropolitan Dredging Co., Lynn, Mass	28	42,000
Moore & Wright, Portland, Me	27	40,500
Augustus B Martin, Boston, Mass	32	48,000

All bids rejected as being too high.

COMMERCIAL STATISTICS.

No statistics could be obtained.

Mr. E. B. Mallett, jr., of Freeport, writes as follows:

"I am in receipt of yours of the 10th, and in reply will give all the information I can. At the present time the number of vessels arriving and departing is of no account, simply because our channel is not dredged out. We have our steamboat which makes two trips daily between South Freeport and Portland. If the channel was dredged to Porters Landing she could come up to within 1 mile of the center of our village, which is very much desired.

"All our coal could come to Porters Landing, and as we are now using some 4,000 tons yearly, and as it would save at least 75 cents per ton, you can see how much it would help if our channel was opened to the Landing.

"I am at present unable to handle a vast amount of granite, because I can not reach places by rail, and their freights by rail, that could be reached by water are too large.

"I could make and ship hundreds of thousands of paving, and ship them to New York, Philadelphia, Baltimore, and other places in the South if I could ship by water.

"I tell you that it is of great importance to us if we can get our channel dredged so as to give us water communication. I could have sold 500,000 paving 'in places reached by water' last summer if I could have shipped them. * * *"

A 13.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

The commercial importance of Portland was recognized in the early days when Congress began a system of internal improvements for the country. The first appropriations were made for the construction of a breakwater on Stamford Ledge, in Portland Harbor, according to the plan of John Anderson, of the Corps of Engineers, in 1836. Subsequent appropriations ran the aggregate up to about $166,000. The breakwater was completed in 1875, according to the plans of Col. B. S. Alexander, which plans had been submitted to and approved by a board of engineers, consisting of Col. H. Bache, Lieut. Col. George Thom, and Maj. T. L. Casey, in 1867.

The first regular appropriation for deepening the waters of the har-

bor was made in 1870, though by joint resolution of Congress approved June 5, 1868, the Chief of Engineers was authorized to expend so much of the unexpended balance of the appropriation of 1866 for the breakwater, as he might deem proper, in excavating the middle ground near said breakwater and in otherwise protecting and improving the channel, so that the appropriation of 1866 for the breakwater, and subsequent appropriations for improving Portland Harbor, were expended partly on the breakwater and partly in dredging.

The first regular project for dredging the harbor was submitted by Col. George Thom, June 30, 1868, in which he recommended the excavation of a channel 300 feet wide through the southern slope of the middle ground to the depth of 20 feet at mean low tide, and the removal of the bar off Grand Trunk Wharves to the same depth. The project was approved. The estimated cost was $28,600.

The estimated cost of completing the breakwater at the time this report was made was $59,984, and as $92,000 of the appropriation of 1866 was at that time available, no additional funds were needed over what had already been appropriated.

In 1869 an extension of the breakwater 190 feet was added to the project, and subsequently a further extension of 200 feet was ordered.

In 1870 the project for the channel improvement was amended so as to provide for a channel 400 feet wide, instead of 300, and in 1871 it was still further added to by making it 500 feet wide, the extra cost of these additions to the project being $65,000.

The act of Congress of June 10, 1872, made an appropriation of $45,000 for Portland Harbor and Back Bay. The approved project for this latter improvement was estimated to cost $15,000. The improvement contemplated was the enlargement, by dredging, of the channel leading from Tukeys Bridge southwardly to the stone wharves.

In December, 1872, there was added to the project a plan to dredge the inner harbor to a depth of 16 feet up to the harbor commissioner's lines, beyond which several wharves extended. The estimated cost of this additional improvement was $110,000, but it was not designed to expend it until the outer ends of the projecting wharves had been removed. By 1876 all the work projected for the improvement of the harbor had been completed except the dredging in the inner harbor in front of the harbor commissioner's lines above Merrills Wharf.

The total expenditures up to 1876 had been $306,908.07, which expenditures had been of great benefit to the commerce of the city.

No appropriation was made between 1875 and 1881.

A resurvey of the harbor was made in 1880, which showed that the dredged channels up to that time had not deteriorated.

A new appropriation was made in 1881, and with a view to the further improvement of the harbor a project and estimate for the removal of the entire area of the shoal known as the middle ground to a depth of 21 feet, at an estimated cost of $160,000, was adopted. The work on this latter project was continued until 1885, when it was completed. The total expenditures on the entire harbor up to June 30, 1885, were $427,929.21. In 1886 the board of trade and other parties interested asked for still further improvement of the harbor to a depth of 29 feet at mean low tide. A project for this improvement, at an estimated cost of $135,000, was approved in 1886. In 1890 the project was extended to include some dredging in the upper harbor to 16 feet, at an estimated cost of $5,000.

The following appropriations have been made:

July 4, 1836, for breakwater	$10,000.00
March 3, 1837, for breakwater	25,000.00
July 7, 1838, for breakwater	26,366.00
June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868	105,111.05
July 11, 1870, for improving harbor	10,000.00
March 3, 1871, for improving harbor	40,000.00
June 10, 1872, for improving Portland Harbor and Back Bay	45,000.00
March 3, 1873, for improving harbor	50,000.00
June 23, 1874, for improving harbor	20,000.00
March 3, 1875, for improving harbor	20,000.00
March 3, 1881, for improving harbor	20,000.00
August 2, 1882, for improving harbor	35,000.00
July 5, 1884, for improving harbor	30,000.00
August 5, 1886, for improving harbor	30,000.00
August 11, 1888, for improving harbor	40,000.00
September 19, 1890, for improving harbor	40,000.00
July 13, 1892, for completing improvement	30,000.00
Total	576,477.05

The total expenditures up to June 30, 1892, were $509,662.84.

Before the improvement of the harbor was begun the greatest depth at mean low tide across the bar between the middle ground and Stamford Ledge was 16 feet, while the depth on the middle ground itself was only from 8 to 10 feet at mean low tide. The depth in the inner harbor along the front of the wharves was in places no more than 4 feet. The expenditures have resulted in removing the entire area of the middle ground up to the harbor commissioner's line, giving a wide and commodious entrance 29 feet deep at mean low tide; also in giving a depth of 16 feet at mean low tide within the inner harbor along the wharves and up to the harbor commissioner's lines and a breakwater to protect the anchorage.

The expenditures in the fiscal year ending June 30, 1893, have been $41,673.59.

At the date of my last annual report dredging under the 29-foot project was in progress under contract with Moore & Wright, of Portland, Me. Work was commenced April 26, 1892, and completed February 20, 1893. Dredging was carried on throughout this entire period, excepting about two weeks in January, 1893, when a suspension was caused by bad weather and the material freezing in the scows. The total quantity of material dredged under this contract was 318,039 cubic yards, measured in place—73,255 cubic yards at 19 cents and 244,784 cubic yards at 9½ cents per cubic yard. This completed that part of the project providing for a 29-foot depth in the lower harbor, giving a channel 500 feet wide and 29 feet deep at mean low tide from the deep water of the anchorage to the lower wharves, with a large area of the same depth in front of the wharves.

November 16, 1892, proposals were opened for a small amount of 16-foot dredging in the upper harbor, and a contract was made with Moore & Wright, December 19, 1892, at 28 cents per cubic yard, scow measurement. The work was commenced February 23, 1893, and completed early in the following month, 7,797 cubic yards of material having been dredged. This completed the project of 1886 for improving Portland Harbor.

The total amount of dredging done in the harbor up to the end of the fiscal year ending June 30, 1893, has been about 1,708,051 cubic

yards. The total amount of stone built in the breakwater is about 45,000 tons.

The harbor is defended by Forts Preble, Gorges, Scammel, and a battery at Portland Head. There is a light-house on the breakwater and one at Portland Head, 3 miles distant from the city. The harbor is in the collection district of Portland and Falmouth, of which Portland is the port of entry.

Money statement.

July 1, 1892, balance unexpended	$36,814.21
Amount appropriated by act approved July 13, 1893	30,000.00
	66,814.21
June 30, 1893, amount expended during fiscal year	41,673.59
July 1, 1893, balance unexpended	25,140.62
July 1, 1893, outstanding liabilities	140.62
July 1, 1893, balance available	25,000.00

Abstract of proposals for dredging in Portland Harbor, Maine, November 16, 1892—

No.	Bidders.	Price per cubic yard (11,000 cubic yards) measured in scow.	Amount.
		Cents.	
1	Charles H. Souther, Boston, Mass	34	$3[illegible] 740
2	Metropolitan Dredging Company, Lynn, Mass	30	3[illegible] 300
3	Moore & Wright, Portland, Me	28	3[illegible] 080
4	Augustus B. Martin, Boston, Mass	35	3[illegible] 850

Contract made with Moore & Wright, December 19, 1892.

Abstract of contracts for improving harbor at Portland, Me., in force during the fiscal year ending June 30, 1893.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price per cubic yard.
*1	Moore & Wright, Portland, Me	Mar. 7, 1891	Dredging channel 500 feet wide to 29 feet, m. l. w.	Cents. [illegible] 9
*2	do	Dec. 19, 1892	Dredging channel, upper part harbor, to 16 feet, m. l. w.	[illegible] 94 [illegible] 28

*Contract completed.
‡For soft dredging, in place.
†For hard dredging, in place.
§In scow.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Apples	7,400	107,801	5,733
Bacon, pork, and provisions	7,227	810	18,700
Bricks		4,675	7,350
Coal	450,000	600,000	600,000
Cattle on the hoof		3,185	3,513
Cement and lime		14,915	17,165
Cotton		2,874	3,815
Cooperage		2,345	5,514
Fish	12,150	13,052	10,000
General merchandise and flour	100,530	482,626	377,417
Grain and hay		29,936	91,970
Ice	30,000	6,154	26,637
Iron, machinery, and castings	2,100	2,773	7,650
Lumber	190,810	39,162	65,328
Molasses and sugars	51,638		8,360
Miscellaneous	209,569	20,000	73,227
Oil and paints		20,862	26,531
Sand, stone, clay, and whiting		16,703	22,455
Salt, brimstone, and rags	17,292	364	4,766
Railroad ties			685
Total	1,078,716	1,368,237	1,376,815

Number of arrivals in calendar year 1892.

Steamers, coast trade, 1,100 to 1,500 tons each	*741
Coast trade, about 150 tons each	*52
Foreign trade, 3,000 to 6,000 tons each	48
Sailing vessels, foreign trade, drawing from 11 to 22 feet	244
Coast trade, drawing from 10 to 22 feet	906
For refuge only	2,000
Vessels entered at the custom-house	679
Vessels cleared at the custom-house	631

A 14.

IMPROVEMENT OF CHANNEL IN BACK COVE, PORTLAND, ME.

The first work done in Back Cove was ordered in the river and harbor act of 1872. The project was for dredging a channel in "Back Bay" 100 feet wide and 8 feet deep at mean low tide, from Tukeys Bridge to the "Stone-shed Wharves." The estimated cost was $10,000. The work was completed in January, 1874.

The act of August 5, 1886, appropriated $26,250 for continuing the improvement of Back Cove. A survey was made in 1886, and a project adopted having in view the straightening and deepening of the channel to a depth of 12 feet at mean low tide and to a width of 300 feet, following the harbor commissioner's lines along that part of the Cove which borders the city, a distance of about 5,600 feet, with a turning basin at the upper end. The estimated cost of this project was

*Does not include a number of steamers which ply from Portland to points in Casco Bay, 3 to 14 miles distant.

$181,000, which, in 1888, was revised in consequence of a trifling modification in the location, and put at $180,000. This project is now in process of execution.

The following appropriations have been made:

Act of—

June 10, 1872, for improvement of Portland Harbor and Back Bay	$45,000
August 5, 1886	26,250
August 11, 1888	25,000
September 19, 1890	25,000
July 13, 1892	20,000

When work under the existing project was commenced the channel had a depth at low tide of about 8 to 10 feet for about one-half its length; in portions of the remaining length the depth at low tide did not exceed 1 foot.

The expenditures to the close of the fiscal year ending June 30, 1892, under the existing project, amounted to $51,691.61. At the latter date the channel had been extended for a distance of 4,050 feet, 12 feet deep at low tide and 90 feet wide and a turning basin 400 feet wide excavated.

The expenditures during the fiscal year ending June 30, 1893, were $24,638.60.

Dredging, under a contract with National Dredging Company, was commenced July 1, 1892, and the contract was completed December 6, 1892. Two hundred and eight thousand and fifty-five cubic yards of material were dredged from the channel. The price was 11 cents per cubic yard. The present condition of the work is as follows: The channel has been extended for a distance of about 1,400 feet to a width of 160 feet, about 1,400 to a width of 265 feet, and the remaining length to a width of 90 feet, with a turning basin 400 feet wide at the upper end, all to the depth of 12 feet at mean low tide.

Proposals for dredging were opened October 3, 1892. The lowest bid was 27 cents per cubic yard, but all bids were rejected, the prices being regarded as high. The work was readvertised, and bids again opened November 16, 1892, and again rejected for the same reason. The lowest bid at the latter date was 25 cents per cubic yard.

Back Cove is a part of Portland Harbor, and is therefore in the same collection district; is defended by the same forts, and the same light-houses are near it as are given for Portland Harbor.

Money statement.

July 1, 1892, balance unexpended	$24,558.39
Amount appropriated by act approved July 13, 1892	20,000.00
	44,558.39
June 30, 1893, amount expended during fiscal year	24,638.60
July 1, 1893, balance unexpended	19,919.79
Amount (estimated) required for completion of existing project	83,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Back Cove, Portland Havbor, Maine, October 3, 1892.

No.	Bidders.	Price per cubic yard (125,000 cubic yards), scow measurement.	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	27	$33,750
2	Metropolitan Dredging Co., Lynn, Mass	34	42,500
3	Augustus B. Martin, Boston, Mass	32	40,000
4	Charles H. Souther, Boston, Mass	31½	39,375
5	National Dredging Co., Wilmington, Del	33	41,250

All bids rejected as being too high.

Abstract of proposals for dredging in Back Cove, Portland Harbor, Maine, November 16, 1892.

No.	Bidders.	Price per cubic yard (110,000 cubic yards), scow measurement.	Amount.
		Cents.	
1	Charles H. Souther, Boston, Mass	26	$28,600
2	Metropolitan Dredging Co., Lynn, Mass	26	28,600
3	Moore & Wright, Portland, Me	25	27,500
4	Augustus B. Martin, Boston, Mass	30	33,000

All bids rejected as being too high.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Coal	9,552	11,586	35,771
Clay and sand	12,529	15,868	19,025
Granite		635	
Wood			125
Railroad ties			560
Total	22,081	28,089	55,481

Number of vessels arriving in calendar year 1892.

Sailing vessels:

Drawing from 15 to 20 feet, 1,000 to 1,500 tons each	7
Drawing from 12 to 17 feet, 500 to 1,000 tons each	30
Drawing from 9 to 10 feet, 200 to 500 tons each	50
Drawing less than 9 feet, 35 to 150 tons each	137

A 15.

IMPROVEMENT OF SACO RIVER, MAINE.

The first appropriation made for the improvement of the Saco River was in 1827, when $7,000 was appropriated for the erection of piers, placing beacons and buoys, and removing obstructions at and near the entrance to the harbor. With the expenditure of these funds it appears that twelve piers were constructed within the river, the object of which was to keep vessels from drifting on to the rocks and ledges, and two outside piers which were evidently intended for breakwaters. No further appropriations were made until 1866, when an appropriation of $40,000 was made for continuing the repairs of piers in the Saco River.

In 1866 a plan was proposed by Mr. George Davidson, of the Coast Survey, for the construction of two stone piers conducting the river to the sea in a northeasterly direction, at an estimated cost of $40,000. In the same year Maj. B. S. Alexander, of the Corps of Engineers, submitted a plan for the construction of a breakwater between the two outside piers, 2,915 feet in length, 12 feet above low tide, the outer face to be of cut granite and the inner of rubblestone, the estimated cost of which was $192,500. The project of Maj. Alexander was modified, at the suggestion of Col. George Thom, Corps of Engineers, by adding to it the repairing and rebuilding of the inside piers, the total cost of the entire project being estimated at $211,701. The latter project was approved March 28, 1867, with the condition that the position of the breakwater should first be determined by a board of engineers. Such a board, consisting of Maj. Casey, Lieut. Col. Thom, and Col. H. Bache, approved the location proposed by Maj. Alexander, Corps of Engineers. The estimated cost was subsequently increased to $270,000, and in 1868 to $320,000.

The project in 1868 was the construction of the breakwater at the mouth of the river, the removal of sunken rocks, and the rebuilding of some of the most important piers in the river. The coping or paving of the outer slopes of the breakwater was afterwards dispensed with, and some of the other work was apparently done at a lower cost than the estimates, so that the entire project was completed in 1873 at a total cost of $169,275.

Nothing more was done from 1873 to 1882. In the latter year a resurvey of the breakwater was ordered by act of Congress. This survey was made in 1883 under direction of Col. Blunt, Corps of Engineers, and an estimate submitted for extending the breakwater out to Sharps Ledge, raising and repairing the one in existence, constructing another of less height on the south side of the entrance, and for dredging. The total estimated cost of the improvement was $356,000. The resurvey showed that the breakwater did not prevent the accumulation of sand on the south side of it, so that the bar had again become an obstruction.

In 1884 an appropriation of $15,000 was made for improving breakwater at mouth of Saco River and repairs to same. This was a single item in the foregoing estimate, and the improvements and repairs suggested were estimated to cost $70,000, so that the project for improvement at the mouth of the river became repairing and raising the existing breakwater to a height of 15 feet above mean low tide, and a width of 12 feet on top.

The same act of Congress that made an appropriation for the breakwater ordered a preliminary examination and survey of Saco River. A report of this survey was submitted October 16, 1885, and a project for

ving the navigation of the river proper from its mouth to the of Saco and Biddeford was suggested, at an estimated cost of 0. This amount was expected to give a continuous channel of 6 ; mean low tide to the head of navigation from the bar.

886 two appropriations were made, one for the river proper and her for the repair and completion of the breakwater. The same lone in 1888. In 1889 the engineer recommended that the two ts be combined in one. The revised estimate of the cost of the two ıen put at $185,000—$30,000 to complete the breakwater and 00 to give 6 feet at mean low tide from the sea to Biddeford and ıt the head of navigation. This estimate included the construc- f a jetty on the south side of the mouth of the river. The appro- ɔn made in 1890 was understood to be for continuing work on the ned project.

following appropriations have been made:

2, 1827, for piers, buoys, and removing obstructions at and near en- e	$7,000
, 1866, for repairing piers	40,000
2, 1867, for improving river	40,000
, 1868, for improving river	20,000
0, 1869, for improving river	22,275
, 1870, for improving river	10,000
3, 1871, for improving river	15,000
, 1872, for improving river	15,000
1884, for breakwater	15,000
5, 1886, for breakwater	12,500
5, 1886, for improving river	12,500
11, 1888, for breakwater	12,500
11, 1888, for improving river	10,000
ber 19, 1890, for improving river, including breakwater and jetty	65,000
, 1892, for improving river, including breakwater	25,000
otal	321,775

total expenditures on both river and breakwater up to June 30, ıave been $256,937.22.

river before the improvement was begun was obstructed at its by a bar on which there was only about 2 feet of water at low hough much of the river was deeper, and by ledges and bowlders. vift currents also tended to sweep vessels on the rocks and ledges. expenditures up to June 30, 1892, have resulted in removing the rous ledges, constructing piers against which vessels could touch ıt danger of damage, the construction of a substantial break- on the north side of the entrance, and the partial construction ɔtty to contract the channel way on the south side. The break- on the north side has made navigation at the entrance easier, e deepening of the water, which it was expected its construction cause, has not yet been accomplished.

expenditures during the fiscal year ending June 30, 1893, have 34,760.07.

he date of my last annual report the construction of a riprap n the south side of the mouth of the river was in progress under ract with George Willett Andrews. The work was continued he last of November, 1892, when the contract was completed. tal quantity of stone deposited under this contract was 47,271 onstructing 3,250 feet of jetty.

posals were invited for extending the south jetty about 1,000 feet, so for dredging through the bar at the mouth of the river, the) be opened July 13, 1892. No bids were received for the dredg- ıt a contract was made July 25, 1892, with Joseph F. Curit, of agne, Me., for extending the south jetty, at 90 cents per ton.

The contractor began work early in August, 1892, and when operations were suspended, about the middle of the following November, he had put in place 10,816 tons of stone, nearly completing his contract.

The dredging of the bar at the mouth of the river was, in combination with dredging at Cow Island, again offered, and the bids opened November 16, 1892. The bids were regarded as high and were all rejected.

December 3, 1892, proposals were opened for construction of a jetty at the head of Cow Island, and one just below the island. A contract was made December 17, 1892, with John F. Hamilton, of Portland, Me., at 93 cents per ton for stone and 75 cents each for fascines.

Work on the jetty at the head of Cow Island was commenced during the latter part of January, 1893, and continued until early in March, the contractor working on the ice. The jetty was practically completed for about three-fourths of its length, when the ice became unsafe and the contractor had to withdraw. Work was resumed with vessels on the 14th of April, and by the close of the year about two-thirds of the work covered by the contract had been completed.

The construction of the jetty on the south side of the entrance has given an increased depth between it and the breakwater, and the construction of the extension is with a view to securing the full projected depth through the bar.

The improvements already made have been of material aid to commerce, but it is impracticable as yet to state the effect of the contraction works, comprising the operations during the past year.

Saco River is in the collection district of Saco, Me., of which Saco is the port of entry. The nearest light-house is Wood Island.

Money statement.

July 1, 1892, balance unexpended		$39,837.
Amount appropriated by act approved July 13, 1892		25,000.
		64,837.
June 30, 1893, amount expended during fiscal year		34,760.
July 1, 1893, balance unexpended		30,077.
July 1, 1893, outstanding liabilities	$1,898.23	
July 1, 1893, amount covered by uncompleted contracts	7,942.77	
		9,841.
July 1, 1893, balance available		20,236.
Amount (estimated) required for completion of existing project		72,500.
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for construction of riprap jetty at mouth of Saco River, Maine, July 13, 1892.

No.	Bidders.	Price per ton (12,000 tons stone).	Amount.
		Cents.	
1	Aaron Cleaves, Chebeague, Me	97	$11,
2	George Willett Andrews, Biddeford, Me	97	11,
3	Joseph F. Curit, Chebeague, Me	90	10,
4	Jordan & Carlton, Bath, Me	98	11,

Contract made with Joseph F. Curit, July 25, 1892. Proposals were invited at the same time for dredging Outer Bar, but none were received.

Abstract of proposals for dredging at mouth of Saco River, Maine, November 16, 1892.

No.	Bidders.	Cow Island (45,000 cubic yards).	Outer Bar (15,000 cubic yards).	Bowlders (350 cubic yards).	Amount.
1	Hamilton & Sawyer, Chebeague, Me	$0.45	$0.98	$0.80	$35,230.00
2	Charles H. Souther, Boston, Mass	.52	1.02	.83	38,990.00
3	Metropolitan Dredging Co., Lynn, Mass	.47	.98	1.25	36,287.50
4	Moore & Wright, Portland, Me	.40	.90	.75	31,762.50
5	Augustus B. Martin, Boston, Mass	.50	1.00	1.00	37,850.00

All bids rejected as too high.

Abstract of proposals for construction of riprap jetties in Saco River, Maine, December 3, 1892.

No.	Bidders.	Stone (14,000 tons).	Fascines (800).	Amount.
		Cents.	*Cents.*	
1	George Willett Andrews, Biddeford, Me	93	75	$13,620
2	John F. Hamilton, Portland, Me	93	75	13,620

Contract made with John F. Hamilton, December 17, 1892.

Abstract of contracts for improving Saco River, Maine, in force during the fiscal year ending June 30, 1893.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price.
				Cents.
*1	George Willett Andrews, Biddeford, Me.	Jan. 24, 1891	Stone jetty at mouth of river	†84
*2	Joseph F. Curit, Chebeague, Me	July 25, 1892	Extension of stone jetty at mouth of river.	†90
3	John F. Hamilton, Portland, Me	Dec. 17, 1892	Construction of riprap jetties near Cow Island.	†93 ‡75

*Contract completed. †Per ton for stone. ‡For each fascine.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Brick	6,160	6,000	6,100
Coal	33,015	40,724	39,266
Cement and lime	938	485	360
Iron	1,384	1,684	972
Lumber	738	80	120
Molding sand	565	480	250
Powder and ashes		92	
Roofing gravel		220	40
Granite	75		
Ice	1,212		
Total	44,087	49,765	47,108

Number of vessels arriving in calendar year 1892.

Sailing vessels—	
Drawing 8 to 11½ feet	128
Drawing 11½ to 12 feet	30
Cleared, foreign	9

A 16.

IMPROVEMENT OF KENNEBUNK RIVER, MAINE.

The Kennebunk River is a small stream that empties into the Atlantic about 30 miles south of Portland. Formerly the shipbuilding industry on this river was very great, though the river itself was small. Of late years this industry has fallen off to almost nothing.

The first appropriation for the improvement of the river by the National Government was made in 1829. This was for repairing the pier on the east side of the channel at the entrance to the river, which had been constructed by private enterprise many years before. Appropriations were made between 1829 and 1852 for piers at the mouth of the river. These were designed to improve the course and depth of the channel entrance, and a wharf built a short distance upstream was for the security of vessels when they were detained by the tide and storms.

With the appropriations made in 1870 and 1871 the piers were extended and repaired and the wharf was also repaired. This work was completed in 1872.

In 1876 a project was adopted, the object being to afford a channel of navigable width from the mouth of the river up to Kennebunkport a distance of about 1½ miles, and of a depth of not less than 4 feet at mean low tide, or 13 feet at high tide. This work was accomplished by dredging at the Wading Place and at Mitchells Point, and removing sunken ledges below Wards Wharf and others near the mouth of Gooch Creek, so as to give a depth of 4 feet at mean low tide. The project was completed in 1882, but the dredged channels subsequently filled up again.

The river and harbor act of 1888 directed a survey of the Kennebunk River, which was made in 1889, and a new project submitted, the estimated cost of which was $20,000. The object of the work proposed was the repair of the jetties or piers at the mouth of the river, the repair of the wharf above, at which vessels tied up when detained by tides and storms and the contraction of the stream at Wading Place by a small stone jetty. The project was approved December 19, 1890 and its execution was commenced in 1891.

The following appropriations have been made:

March 2, 1829	$5,000	March 3, 1871	$5,00
March 2, 1831	1,175	August 14, 1876	5,00
February 24, 1832	1,700	March 3, 1879	2,00
June 28, 1834	10,300	June 14, 1880	2,00
July 2, 1836	7,500	March 3, 1881	2,00
March 3, 1837	3,000	September 19, 1890	20,00
July 7, 1838	8,000		
August 30, 1852	7,500	Total	85,17
July 11, 1870	5,000		

The expenditures up to June 30, 1892, have been $79,911.71. These expenditures have accomplished the construction of two piers or jetties at the mouth of the river and kept them in repair for many years, the construction and repair of the wharf, the construction of a jetty or dike at Wading Place, and some dredging, which was done years ago.

The expenditures during the year ending June 30, 1893, have been $3,672.30. These were applied to completing the permanent repairs to the wharf, and to repairing or strengthening the jetty on the north side of the mouth of the river. The work was finished during the season of 1892, completing the project.

There is but little commerce on the river and none is expected to be developed by the improvements. The place is visited chiefly by small sailing vessels and pleasure craft.

The river is in the collection district of Kennebunk, which is the nearest port of entry. The nearest light-house is on Goat Island, near Cape Porpoise.

Money statement.

July 1, 1892, balance unexpended	$5,179.80
June 30, 1893, amount expended during fiscal year	3,672.30
July 1, 1893, balance available	1,507.50

Abstract of proposals for completing construction of stone wharf and rough stone in jetty at mouth of Kennebunk River, Maine, July 18, 1892.

No.	Bidders.	Dimension stone for wharf (420 tons).		Stone for backing (200 tons).		Fender timbers (5).		Stone for jetty (700 tons).		Total.
		Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.	
1	Joseph F. Curit, Chebeague, Me...	$1.90	$798.00	$1.05	$210.00	$20.00	$100.00	$1.50	$1,050.00	$2,158.00
2	Solon S. Andrews, Gorham, Me.....	2.35	987.00	1.50	300.00	25.00	125.00	1.35	945.00	2,357.00

Contract made with Joseph F. Curit, July 25, 1892.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Coal	2,166	3,695	3,900
Lumber	1,814	1,000	
Total	3,980	4,695	3,900

Number of vessels arriving in calendar year 1892.

Sailing vessels, drawing 10 feet or more 21

Vessels built in 1892.

	No.	Tonnage.
		Gross tons.
Barges	3	393
Scow-sloops	2	115
Steamer	1	28

A 17.

IMPROVEMENT OF HARBOR AT YORK, ME.

York Harbor is located at the mouth of York River, a small stream that empties into the Atlantic Ocean about 10 miles east of Portsmouth, N. H.

A survey was made in 1884, and a report thereon submitted in February, 1885, in which a project of improvement was suggested. This project had for its object (1) the removal by dredging of part of the spit off the southwest point of Stage Neck; (2) the removal of part of a sand shoal off Bragdons Island, and (3) the removal of the upper shoal just north of Bragdons Island. The object of the improvement was to widen and straighten the channel, which was very crooked and difficult to navigate, and give a navigable channel of 10 feet at mean low tide. The estimated cost of the project was $25,000.

The project was approved in 1886, after the first appropriation for the work was made and its execution was entered upon.

In 1887 it was found that the prices on which the estimate was based were too low, so the estimate was revised and increased to $30,000.

Subsequently it was found that part of the spit off Stage Neck was ledge instead of loose rock and gravel, and in 1888 the estimate was again revised and made $44,000.

The following appropriations have been made:

August 5, 1886	$15,000
August 11, 1888	10,000
September 19, 1890	10,000
July 13, 1892	9,000

The total expenditure up to June 30, 1892, have been $35,000.

With these expenditures the following work has been accomplished: Part of the shoal at the entrance to the harbor has been removed by dredging and rock excavation to a depth of 10 feet at mean low tide, thereby increasing the width of the channel at the narrowest point from 90 feet to about 150 feet. A part of the shoal in the upper part of the harbor has also been removed by dredging to the same depth, increasing the width of the 10-foot channel at that point about 100 feet.

The expenditures during the fiscal year ending June 30, 1893, were $23.94.

The appropriation of 1892 is for completing the improvement.

Proposals for dredging were opened November 16, 1892, and a contract was made December 21, 1892, with Augustus B. Martin, of Boston, Mass., for dredging at the entrance to the harbor at 68 cents per cubic yard, and for dredging in the harbor basin at 36 cents per cubic yard, the work to be done during the present season.

The improvement is in the collection district of York. The nearest light-house is Cape Neddick, 3 miles distant.

Money statement.

ount appropriated by act approved July 13, 1892		$9,000.00
ıe 30, 1893, amount expended during fiscal year		23.94
y 1, 1893, balance unexpended		8,976.06
y 1, 1893, outstanding liabilities	$50.00	
y 1, 1893, amount covered by uncompleted contracts	8,100.00	
		8,150.00
y 1, 1893, balance available		826.06

Abstract of proposals for dredging in York Harbor, Maine, November 16, 1892.

Bidders.	At entrance (6,000 cubic yards). Price per cubic yard.	Harbor Basin, (20,000 cubic yards). Price per cubic yard.	Amount.
	Cents.	*Cents.*	
Charles H. Souther, Boston, Mass	77	41	$12,820
Augustus B. Martin, Boston, Mass	68	36	11,280
Moore & Wright, Portland, Me	75	40	12,500

Contract made with Augustus B. Martin, December 21, 1892.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
pples			90
icks	6,750	3,500	1,800
al	2,000	400	600
rm produce		100	90
sh and oysters	75	100	
ain		500	
neral merchandise	1,000	500	650
y, wood, and potatoes	5,000	1,100	1,500
me and cement	267	150	
mber	3,000		600
Total	18,092	6,350	5,330

Number of vessels arriving in calendar year 1892.

iling vessels drawing 9 feet	50
iling vessels entered for refuge	20

A 18.

IMPROVEMENT OF BELLAMY RIVER, NEW HAMPSHIRE.

The Bellamy River to the head of navigation is a tidal branch of Great Bay, which empties into the Piscataqua River at Dover Point, 4 miles above the bridge at Portsmouth, N. H. At low water the channel of the river is too shoal for any navigation, except for a short distance from its mouth. The distance over which improvements are projected is about 2½ miles.

A survey was made of the Bellamy River in 1887 and a project of improvement suggested, at an estimated cost of $28,000, which was increased in 1891 to $35,000. The project is to secure a channel 50 feet wide and 5 feet deep at mean low tide from the mouth of the river up to Sawyer's Mill at Dover. The rise and fall of the tide being about 7 feet a high-water navigation of 12 feet will be secured.

The above project was adopted in 1888 and its execution is now in progress.

The following appropriations have been made:

August 11, 1888	$10,000
September 19, 1890	10,000
July 13, 1892	7,500

The expenditures, up to the close of the fiscal year ending June 30, 1892, have been $10,120.34. These expenditures have resulted in giving a channel from the mouth of the river up to about 1 mile above Roberts's brickyard 50 feet wide and 5 feet deep at low tide. In other words, about 1 mile was added to the navigable part of the river.

The expenditures during the fiscal year ending June 30, 1893, have been $9,561.27.

Dredging under a contract made during the previous fiscal year was in progress during the early part of the year just ended, and the contract was completed early in August, 1892; 35,997 cubic yards of material were dredged, adding about three-fourths of a mile to the navigable part of the river.

Proposals for dredging were opened November 16, 1892, but the prices being high all bids were rejected. The work will be readvertised.

There is no trade on the river at present beyond the brickyard, near which the first dredging was begun, but it is thought that the improvement of the river in the upper part will develop the manufacture of bricks, an extra good quality of which, it is reported, can be made here; and it will also enable coal and other mill supplies to be shipped to Sawyer's Mill and the western part of Dover at a less cost than at present.

Money statement.

July 1, 1892, balance unexpended		$9,879.66
Amount appropriated by act approved July 13, 1892		7,500.00
		17,379.66
June 30, 1893, amount expended during fiscal year		9,561.27
July 1, 1893, balance unexpended		7,818.39
Amount (estimated) required for completion of existing project		7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		7,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Bellamy River, New Hampshire, November 16, 1892.

No.	Bidders.	Price per cubic yard (35,000 cubic yards).	Amount.
		Cents.	
1	Charles H. Souther, Boston, Mass	34	$11,900
2	Augustus B. Martin, Boston, Mass	29	10,150
3	Moore & Wright, Portland, Me	35	12,250
4	Metropolitan Dredging Co., Lynn, Mass	35	12,250

All bids rejected as being too high.

A 19.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

The Cocheco River is a branch of the Piscataqua, which empties into the sea at Portsmouth, N. H. Dover is the head of navigation and here the mean rise and fall of tides is about 7 feet.

From Dover to the Lower Narrows, a distance of about 1½ miles, the river was much obstructed by bowlders, ledges, and shoals, the depth of water being only from 6 inches to 2 feet at mean low tide. Appropriations amounting to $10,000 were made as early as 1836 and 1837 "for deepening the channel of the Cocheco branch of the Piscataqua leading into Dover Harbor," but the records do not show what work was accomplished.

The first regular project for the improvement of the river was based on an examination made in 1870, and consisted in making a channel not less than 40 feet wide and 4 feet deep at mean low tide from the lower narrows up to Collins Wharf, at the head of the upper narrows. The estimated cost of the project was $45,000.

Subsequently more accurate and extended surveys having shown the practicability of extending the improvement up to Packets Landing and thence to make a channel 2 feet deep at low tide, corresponding to 9 feet at high tide, and a width of 30 feet, up to the bridge at the head of navigation, the estimate was increased, to suit the latter project, to $85,000. This sum was appropriated between 1871 and 1878, and by 1879 all the improvements at that time contemplated were completed.

These improvements opened up a large commerce employing large vessels where formerly flatboats had been used. Owing to the abrupt turns, however, in the channel at the Lower Narrows these vessels had difficulty in passing that place. The larger vessels that came into use required a wider and deeper channel.

A new project was therefore adopted providing for making a cut-off channel through Alleys Point, with straight connecting channels above and below, and widening to 60 feet and deepening to 5 feet the existing channels through Trickeys and Clements Point Shoals; $28,000 were appropriated and expended in making the "cut-off" through Alleys Point. The other work of blasting and removing rock and dredging in the upper portions of the river was estimated to cost $47,000 more. This second project was completed in 1888.

The act of August 11, 1888, ordered another survey to be made of the river. The report of this survey is dated December 14, 1889. The large increase in trade seemed to justify still a further improvement of the river, and accordingly a new project was submitted, suggesting an improvement that looks to obtaining a channel depth of 7 feet, in-

creasing to 7½ feet in rock, the channel to have a minimum width of 50 feet where confined in rock, increasing to 60 and 75 feet where the material is less expensive to remove. This last project is estimated to cost $175,000.

The following appropriations have been made for the improvement of this river:

July 4, 1836	$5,000
March 3, 1837	5,000
March 3, 1871	10,000
June 10, 1872	10,000
March 3, 1873	10,000
June 23, 1874	10,000
March 3, 1875	25,000
August 14, 1876	14,000
June 18, 1878	6,000
August 2, 1882	28,000
July 5, 1884	28,000
August 5, 1886	10,000
August 11, 1888	9,000
September 19, 1890	25,000
July 13, 1892	15,000
Total	210,000

The total expenditures on the improvement of the river up to June 30, 1892, have been $194,404.12. These expenditures have resulted in giving a channel through the rocky bed of the river 5 feet deep and 40 feet wide in the narrowest parts, where before the depth was only from 6 inches to 2 feet.

The upper end of the channel at Dover has been deepened to 7 feet at mean low tide for a length of 1,200 feet, with widths varying from 100 feet to 140 feet. Portions of the channel above and below Clement's Wharf, of a total length of 600 feet, have also been dredged to the same depth.

The expenditures during the fiscal year ending June 30, 1893, have been $29.88.

No work was done during the year just ended.

Proposals for dredging, under the appropriation of July 13, 1892, were opened November 16, 1892, and again February 20, 1893, but the bids each time were regarded as high and all were rejected.

The improvements in the navigation of the Cocheco have been of great benefit to the people of Dover and the vicinity. In the item of coal alone, it is reported that not less than 35,000 tons are supplied annually, at a saving of 50 cents per ton, which could not have been done had no improvement been made.

Money statement.

July 1, 1892, balance unexpended		$595.88
Amount appropriated by act approved July 13, 1892		15,000.00
		15,595.88
June 30, 1893, amount expended during fiscal year		29.88
July 1, 1893, balance unexpended		15,566.00
July 1, 1893, outstanding liabilities		25.00
July 1, 1893, balance available		15,541.00
Amount (estimated) required for completion of existing project		135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Cocheco River, New Hampshire, November 16, 1892.

No.	Bidders.	Price per cubic yard, (10,000 cubic yards).	Amount.
1	Charles H. Souther, Boston, Mass	$1.57	$15,700
2	Augustus B. Martin, Boston, Mass	1.40	14,000
3	Moore & Wright, Portland, Me	1.45	14,500

All bids rejected as being too high.

Abstract of proposals for dredging in Cocheco River, New Hampshire, February 20, 1893.

No.	Bidders.	Price per cubic yard, (10,000 cubic yards).	Amount.
1	Moore & Wright, Portland, Me	$1.45	$14,500
2	A. B. Martin, Boston, Mass	1.39	13,900

All bids rejected as being too high.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1890.	1891.	1892.
	Tons.	*Tons.*	*Tons.*
Brick		40,056	*40,000
Coal		26,656	27,855
Cement, lime, and plaster		1,810	1,950
Iron		390	
Lumber		1,500	1,600
General merchandise	40.000		
Phosphates		150	150
Sand (moulding)		100	80
Apples			150
Total	40,000	70,662	71,785

*Estimated.

Number of vessels arriving in calendar year, 1892.

Sailing vessels of from 400 to 500 tons each	27
Sailing vessels of less than 400 tons each	67
Steam tugs plying on the river	3
Barge	1

A 20.

HARBOR OF REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.

At the instance of members of the Marine Society, and the Board of Trade, and other citizens of Portsmouth, a survey of this harbor was made in 1882 by Col. George Thom, Corps of Engineers. The improvement desired at that time was to have the channel of entrance opened to a depth of 9 feet at mean low tide for a width of 100 feet, and to

have the inner basin enlarged to a width of 300 feet for a length of about 700 feet, and the dredged channel and basin protected by a rubblestone breakwater. The estimated cost of the project was $33,000.

The act of Congress of July 5, 1884, directed a preliminary examination and survey to be made with a view to its improvement as a harbor of refuge. This examination was made in the latter part of the year 1884, and an enlarged project submitted for the improvement, the estimated cost of which was $150,000. The former project was not regarded by the district engineer as sufficient to accomplish satisfactory results, and the latter he regarded as too costly to justify the Government in undertaking it. The former project, however, was adopted in 1886, and its execution entered upon.

In 1887 the engineer recommended that the project be enlarged, as the old project did not seem to meet the needs of those interested. A new project was therefore suggested, providing for the construction of two breakwaters, one on the north side and the other on the south side of the entrance, and the dredging of an anchorage behind them of about 49 acres to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was $235,000.

The act of 1888 made an appropriation of $20,000 for the work on the enlarged plan. Before the improvement was undertaken the depth of water in the harbor was only about 6 feet at low tide, and the anchorage was small in area and exposed to the full force of the sea, which is heavy when the winds are strong from the northeast. The object of the improvement is to form a harbor of refuge for small coasters and other vessels that get caught outside and are unable to get into the harbor of Portsmouth on account of the strong ebb tide which sets out to sea. It is said that a number of wrecks have occurred which need not have happened if such a harbor had been in existence.

The following appropriations have been made:

August 5, 1886	$10,000
August 11, 1888	20,000
September 19, 1890	40,000
July 13, 1892	30,000

The total expenditures up to June 30, 1892, were $42,422.83. The results accomplished up to that date were the dredging of a part of the area intended for anchorage ground under the new project and the partial construction of the breakwater on the south side of the entrance.

The expenditures during the fiscal year ending June 30, 1893, have been $3,068.03.

Work on the breakwater on the south side of the entrance, under contract with George Willett Andrews, was commenced in July, 1892. The contractor opened a quarry in the vicinity of the work, but has made but little progress, only 6,096 tons of stone having been deposited to the close of the year.

Proposals for dredging were opened October 3 and November 16, 1892, but each time all the bids were rejected, the prices being considered high. The work was again advertised, and a contract was made February 24, 1893, with Moore & Wright, of Portland, Me., for dredging a channel about 2,600 feet long, 200 feet wide, and 12 feet deep at mean low tide. Work was commenced May 22, 1893, and at the close of the fiscal year the contractor had dredged about 47,500 cubic yards.

There is no commerce, properly considered as such, in Little Harbor. The work is intended as a harbor of refuge, and will doubtless be used only in case of necessity by small coasters which can not reach Portsmouth Harbor in northeasterly storms.

Money statement.

ıly 1, 1892, balance unexpended		$27,577.17
mount appropriated by act approved July 13, 1892		30,000.00
		57,577.17
ıne 30, 1893, amount expended during fiscal year		3,068.03
ıly 1, 1893, balance unexpended		54,509.14
ıly 1, 1893, outstanding liabilities	$662.67	
ıly 1, 1893, amount covered by uncompleted contracts	52,963.29	
		53,625.96
ıly 1, 1893, balance available		883.18
Amount (estimated) required for completion of existing project		135,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Little Harbor, New Hampshire, October 3, 1892.

o.	Bidders.	Price per cubic yard (250,000 cubic yards).	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	26	$65,000
2	Metropolitan Dredging Co., Lynn, Mass	30	75,000
3	Thomas Symonds, Leominster, Mass	30	75,000
4	Augustus B. Martin, Boston, Mass	27⅓	68,750
5	Charles H. Souther, Boston, Mass	27½	69,375
6	National Dredging Co., Wilmington, Del	28	70,000

All bids rejected as being too high.

bstract of proposals for dredging in Little Harbor, New Hampshire, November 16, 1892.

o.	Bidders.	Price per cubic yard (150,000 cubic yards).	Amount.
		Cents.	
1	Charles H. Souther, Boston, Mass	24⅓	$36,750
2	Augustus B. Martin, Boston, Mass	23⅓	35,250
3	Moore & Wright, Portland, Me	24⅓	36,750
4	Metropolitan Dredging Co., Lynn, Mass	25⅓	38,250

All bids rejected as being too high.

bstract of proposals for dredging in Little Harbor, New Hampshire, February 13, 1893.

».	Bidders.	Price per cubic yard (150,000 cubic yards).	Amount.
		Cents.	
1	Moore & Wright, Portland, Me	19	$28,500
2	Augustus B. Martin, Boston, Mass	23⅓	35,250
3	Charles H. Souther, Boston, Mass	24	36,000

Alternative bids for hire of dredging plant to do this work were invited at the ıme time, but none were received.

Contract made with Moore & Wright, February 24, 1893.

Abstract of contracts for improving Little Harbor, New Hampshire, in force during the fiscal year ending June 30, 1893.

No.	Name and address of contractor.	Date of contract.	Subject of contract.	Price.
1	George Willett Andrews, Biddeford, Me.	July 12, 1892	Raising and widening breakwater at Frost Point.	*$1.11
2	Moore & Wright, Portland, Me....	Feb. 24, 1893	Dredging channel to 12 feet at m. l. t.	†.19

* Per ton for stone. † Per cubic yard in scow.

A 21.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During March, 1892, the lime-laden schooner *Isabel Alberto* was sunk in the southern part of Rockland Harbor, Maine, constituting an obstruction to navigation. Under the provisions of the act of June 14, 1880, a contract was made with Enoch Townsend for removing the wreck for the sum of $865. The work was commenced early in August, 1892, and was completed by the 12th of the same month. The total cost in connection with this wreck was $879.59.

December 26, 1891, the *Huntress*, a small schooner laden with coal, was wrecked on Browneys Island, to the southwestward of Moosabec Reach, Maine. During a gale two days later the wreck drifted off the island and sank in deep water, where her masts constituted a dangerous obstruction to navigation. An allotment of funds was made under the provisions of the act of June 14, 1880, and on July 8, 1892, the masts were taken out. The total cost in connection with the wreck was $92.80.

A 22.

PRELIMINARY EXAMINATION OF CHANNEL NEAR HARDYS POINT, BELOW PEMBROKE, MAINE.

[Printed in House Ex. Doc. No. 104, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated October 1, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of preliminary examination of channel near Hardys Point, below Pembroke, Me., made to comply with requirements of the river and harbor act approved July 13, 1892.

Lieut. Col Hains is of opinion that the locality is not worthy of improvement by the General Government, and I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 1, 1892.

GENERAL: In compliance with requirements of Department letter July 14, 1892, I have made a preliminary examination of the chan-el near Hardys Point, below Pembroke, Me., and have the honor to ubmit the following report:

The channel referred to is a part of the head waters of Pennamaquan iver, a tidal estuary of Cobscook Bay. The town of Pembroke is cated near by, and a few years ago large ships were built there. Iron orks were also established, and it is said that a fine grade of iron was anufactured. The shipbuilding industry has disappeared, and the anufacture of iron has ceased.

The country in this neighborhood is healthy, fertile, and fairly well ltivated, and it is claimed that most of the marketable produce is uled in wagons to Eastport, a distance of about 11 miles, as there is) railroad communication, and that by water is available only when ie tide is above the ordinary low stages. In ordinary low spring tides iere is no water at all in the channel near Hardys Point, but the river deep up to within 1¼ miles of that place.

The tide has a mean rise and fall of 18 feet, consequently there is no ck of depth for large vessels at high tide.

A small steamer of about 30 tons register was recently put on the ute between Eastport and Pembroke, as an experiment, and has been nning all summer. She is the only steamer that runs between these oints. As the river is practically dry near Hardys Point at low tide, ie can not land at her wharf in such stages, and consequently can not in on schedule time, unless she makes her landings about a mile below e town. This steamer draws about 7 feet, loaded, and is said to carry out 50 tons of assorted freight and about 100 passengers weekly. uring the winter season she does not run at all. It is thought that e freight and passenger business would be largely increased if she uld run on schedule time, and it would be a great convenience to the ople of Pembroke and vicinity if she did so.

The improvement desired is the dredging of a channel from the deep ter near Smalls Island up to the steamboat landing above Hardy's int. Parties interested in the improvement asked for seem to think at a channel of sufficient dimensions to accommodate this small amer could be made for a very small sum of money, but a channel ep enough to enable even this small steamer to run on schedule time, d make her landings above Hardys Point, would have to be not less an 8 feet deep at low spring tides, or about 11 feet at mean low tide. serviceable channel of that depth can not be made for a small sum money. One of less depth would subject the steamer to occasional lays when low spring tides were coincident with the time of her ival or departure. If any improvement be made at all it should be e that would be of general use and not one exclusively for this small amer.

Such an improvement would call for the excavation of a channel out 100 feet wide and 8 feet deep at low spring tide, with a turning sin 200 feet wide above Hardys Point. * * *

Such an improvement would be a convenience to the people living in e vicinity of Pembroke, but as a business enterprise there does not em to be sufficient commerce in existence, or in prospect, to justify e Government in undertaking such a work. I am therefore of the

opinion that the channel near Hardys Point, below Pembroke, Me., is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 23.

PRELIMINARY EXAMINATION OF SOUTH FORK OF BAGADUCE RIVER, MAINE.

[Printed in House Ex. Doc. No. 17, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated August 17, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of South Fork of Bagaduce River, Maine, made to comply with requirements of the river and harbor act approved July 13, 1892.

Lieut. Col. Hains is of opinion that the locality is not worthy of improvement by the General Government and I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., August 17, 1892.

GENERAL: In compliance with requirements of Department letter dated July 14, 1892, I have made a preliminary examination of the South Fork of the Bagaduce River, Maine, and have the honor to submit the following report:

The South Fork of the Bagaduce is navigable for vessels of a good draft up as far as Johnsons Narrows. The depth in the Narrows, however, is less than 4 feet at mean low tide, and the current, both on ebb and flood, flows with such velocity that it is not navigable at all for sailing vessels except for about half an hour on each slack of the flood tide, in other words, about one-half an hour of daylight. The tide here rises and falls about 9 feet, so that vessels drawing from 10 to 11 feet can pass through at the high-water stage. At no other time, however, can they safely do so, because of the swiftness of the current and the dangerous projecting ledges on either hand.

From Johnsons Narrows to the toll bridge, which is the head of navigation, is a distance of about 1½ miles. The channel over this distance

s somewhat crooked, but the depth of water is greater than in the arrows, and navigation over this portion is less difficult.

The improvements desired are the widening of the Narrows, and the emoval of some of the ledges above, so that sailing vessels may safely avigate this portion of the river.

To make this stretch of the river easily navigable for sailing vessels f from 10 to 12 feet draft is an undertaking of some magnitude, involving considerable expense. I have not the data for making an accurate estimate of the cost of such improvement, but from personal examination I am satisfied it would be great. Some amelioration, however, could be effected at less cost.

* * * * * * *

A steam tug to tow vessels up and down would be of vastly more ervice than the removal of rocks, and doubtless a tug would be used r the purpose if the number of vessels trading there were sufficient to arrant the employment of one. I am informed that about one schooner week passes through Johnsons Narrows.

There is a brickkiln of small capacity about halfway between the arrows and the bridge, and a lumber mill where barrel staves are anufactured near it. Most of the latter are shipped to Boston and ew York. There are no other manufacturing establishments on this art of the river in existence or in prospect. Some wood is brought own from above the bridge, but this is carried in lighters. The country djacent to the stream is fertile and fairly well cultivated.

It does not seem to me that the amount of commerce now on the river ould be materially increased by the improvements referred to, and the mount at present would not, in my opinion, justify the Government in ndertaking the work.

Moreover, the existing project for the improvement of the Bagaduce iver contemplates the expenditure of $1,875 for the removal of rocks n Johnsons Narrows after the work in Northern Bay, contemplated by he project, is completed.

In view of the above I am of the opinion that the South Fork of he Bagaduce River is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 24.

PRELIMINARY EXAMINATION OF VINAL HAVEN, OR CARVER HARBOR, ME.

[Printed in House Ex. Doc. No. 31, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated October 26, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of preliminary examination of Vinal Haven, or Carver Harbor, Me., two names used to designate the same locality, made to comply with requirements of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Hains that the locality is worthy of improvement by the General Government to a limited extent, and he submits an estimate of $800 as the cost of the survey necessary to the preparation of plan and project, with estimate of the improvement proposed.

His views are concurred in by this office.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 26, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Vinal Haven, or Carver Harbor, Maine, and have the honor to submit the following report:

Vinal Haven and Carver Harbor are two names for one and the same place. Vinal Haven is the name of a large island at the mouth of Penobscot Bay. It is also the name of a town located on the island and at the head of Carver Harbor.

The harbor is small in area, but it is easy of access. It is reported that some 5,000 vessels, large and small, arrive and depart from it annually, many of them seeking it as a harbor of refuge. The estimated gross amount of shipments for 1891 is about 95,000 tons. Most of this was granite paving blocks and dimension stone. About 2,000 tons of it were fish, in barrels, boxes, and bundles. The receipts were estimated to amount to about 15,000 tons for the same year, being for the most part granite, lumber, and coal. The total value of receipts and shipments for that year was perhaps $500,000. The last year the receipts and shipments were much less, owing to the strike among the granite cutters.

There are several granite quarries at Vinal Haven, and a fine grade of stone is quarried there. The vessels that carry it generally load to about 14 feet, but as there is for the most part less than 8 feet in the harbor at low tide, they can depart only at or near high tide. This, it is said, sometimes causes vexatious delays, as advantage can not be taken of a fair wind to put to sea, unless the tide is favorable at the same time. With sufficient depth of water there need be no delays on account of low tides, which would be a great convenience.

The fishermen who come in with fish, or for a harbor, draw less water, but even they sometimes find their vessels aground when the wind is favorable for their departure.

The harbor has, it is said, filled up to the extent of 2 to 3 feet in the last twenty years. I am not able to verify this statement, and it does not seem probable, but if it be true it is easily seen that great inconvenience to navigation may result therefrom.

The improvement desired is the deepening of the harbor to about 8 feet or more at mean low tide. It is probable that this depth would answer for a large part of the existing anchorage, but a greater depth may be necessary for a part of it.

In view of the above I am of the opinion that Vinal Haven, or Carver Harbor, is worthy of improvement to a limited extent.

To determine the nature and extent of the improvement, a survey is necessary, and is recommended, the estimated cost of which is $800.

Very respectively, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 25.

PRELIMINARY EXAMINATION OF LINCOLNVILLE (DUCK TRAP) HARBOR, MAINE.

[Printed in House Ex. Doc. No. 100, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated October 17, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Lincolnville Harbor, Maine, locally known as Duck Trap Harbor, made to comply with provisions of the river and harbor act approved July 13, 1892.

Lieut. Col. Hains is of opinion that Lincolnville Harbor is not worthy of improvement by the General Government, and I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 17, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Lincolnville Harbor, Maine, and have the honor to submit the following report:

Lincolnville Harbor is locally known as Duck Trap Harbor. It is located on the west shore of Penobscot Bay, about 9 miles south of Belfast and about 1 mile north of the town of Lincolnville. The harbor is in two parts—an outer and an inner harbor. The latter is of small area and almost entirely landlocked. The depth, however, is only 3 feet at low tide in places, and for the most part at the bottom is bare at that stage. The tide rises and falls about 9½ feet. An insignificant stream called Duck Trap River empties into the inner harbor. At the head of this harbor is a bridge, and a short distance farther on a dam which supplies power for a sawmill. Besides the mill there are two cooper shops, one limekiln, and a wharf.

I was informed that 40,000 barrels are manufactured at this place

and shipped to Rockland annually, where they are used for packing lime. These barrels have a value of about $4,000 to $5,000. It is said that from 8,000 to 10,000 barrels of lime are also shipped.

The back country is not well cultivated, being rough and rocky, but there is plenty of good limestone, and the lime shipped from here is made from it.

A survey was made of this harbor in 1878, under the direction of Col. George Thom, Corps of Engineers, U. S. A., and a plan for deepening the harbor to 3 feet at mean low tide suggested. Such an improvement would, in my opinion, be of little value. Vessels would ground at low or even half tide, just as they do now. If any improvement be made at all, it should be one giving more than 3 feet, as all the freighting is done on vessels that draw about 8 to 9 feet. The number of such vessels, however, is small—too small to justify the Government in expending the amount of money that would be necessary to make a satisfactory improvement. Besides, a dredged channel through the outer harbor, unless protected in some way, would be likely to fill up in southerly gales. * * *

In view of the above facts I am of the opinion that Lincolnville Harbor, Maine, is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 26.

PRELIMINARY EXAMINATION OF FRENCHS BEACH HARBOR, MAINE.

[Printed in House Ex. Doc. No. 25, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated October 17, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Frenchs Beach Harbor, Maine, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Hains, concurred in by this office, that the harbor is not worthy of improvement by the General Government.

Very respectfully, your obedient servant.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 17, 1892.

GENERAL: In compliance with requirements of Department letter of *July* 14, 1892, I have made a preliminary examination of Frenchs Beach *Harbor,* Maine, and have the honor to submit the following report:

Frenchs Beach Harbor (so called) is formed by a slight indentation in the shore line of the west side of Penobscot Bay, about 6 miles north of Camden, and 10 miles south of Belfast. About a mile north of Frenchs Beach is what is locally known as Duck Trap Harbor.

There are two wharves at Frenchs Beach Harbor, both inexpensive affairs. A steamer used to land at the most southerly one of them but she does so no longer. At the other one the bottom is just bare at low tide, the distance to deep water from the end of it being only a few hundred feet.

The country back of Frenchs Beach Harbor is neither fertile nor well cultivated, being rough and rocky, but a good quality of limestone can be obtained in large quantities. I was informed that there are several kilns from 2 to 4 miles back, where good lime is made, and that from 8,000 to 10,000 barrels are shipped annually from Frenchs Beach. The only other produce shipped is hay, and of that the quantity is only about 200 tons annually. I would regard $10,000 as a large estimate of the value of the annual receipts and shipments. The freighting is done on small schooners that draw about 8 to 9 feet of water, and as the mean rise and fall of the tide is over 9 feet, there is no difficulty in floating a vessel in places where the bottom is not bare at low tide. These vessels come to the wharf at high tide, and depart at the same stage.

The improvement desired is the dredging of a channel from the deep water of the bay up to the most southerly of the wharves referred to. There is no well defined natural channel at present, and it is desired that an artificial one be made. Such a channel would not, in my opinion, remain open, but would be filled up in the first southeasterly gale to which the so-called harbor is exposed. Hence there would be needed an annual appropriation for dredging. The extension of the wharf a few hundred feet would render the dredging of a channel unnecessary.

The amount of trade is small; there is no prospect of its being increased to any appreciable extent by the improvements desired, and there is besides an almost absolute certainty of a dredged channel quickly filling up.

In view of the above, I am of the opinion that Frenchs Beach Harbor, Maine, is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col. Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 27.

PRELIMINARY EXAMINATION OF ROCKLAND HARBOR, MAINE.

[Printed in House Ex. Doc. No. 105, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated August 17, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of preliminary examination of Rockland Harbor, Maine, made to comply with the provisions of river and harbor act approved July 13, 1892.

I concur in the opinion of Lieut. Col. Hains that this harbor is worthy of improvement by the General Government.

An estimate of $1,000 is submitted as the cost of the surveys necessary to preparation of plan and project with estimate of improvement proposed.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., August 17, 1892.

GENERAL: In compliance with requirements of Department letter, dated July 14, 1892, I have made a preliminary examination of Rockland Harbor, Maine, and have the honor to submit the following report:

The harbor of Rockland is one of the most important on the coast of Maine. Besides the large commerce of the place, it is used to a great extent as a harbor of refuge for coasters, and thousands of vessels seek its protection during easterly storms. It is no unusual thing to see a hundred vessels at anchor in this harbor in a storm. Its importance as a harbor of refuge, as well as the volume of trade, is on the increase.

The harbor is obstructed by a ledge known as South Ledge, and another, or bunch of bowlders, known as Jameson Point Ledge. Both of these are obstructions to navigation, but as they are well known and are marked by buoys they are not dangerous. There are said to be numerous other bowlders that lie on the bottom, and that are not indicated on charts, and their presence is discovered only when some vessel runs on them. Numerous accidents of this character are reported to have happened.

In view, therefore, of the importance of this harbor, I am of the opinion that it is worthy of improvement, and I recommend that a survey be made to determine the character and cost of such improvement as ought to be made.

It is estimated that a survey will cost about $1,000.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 28.

PRELIMINARY EXAMINATION OF OWLS HEAD HARBOR, MAINE.

[Printed in House Ex. Doc. No. 67, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated *October 18, 1892*, by Lieut. Col. Peter C. Hains, Corps of Engineers, of

the results of a preliminary examination of Owls Head Harbor, Maine, made to comply with provisions of river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Hains, concurred in by this office, that Owls Head Harbor is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brigadier-General, Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 18, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Owls Head Harbor, Maine, and have the honor to submit the following report:

Owls Head Harbor is located on the west side of Owls Head Bay, 2½ miles from Rockland. The harbor is formed by a crescent-shaped indentation in the shore line, which shelters it on the west and north sides, while Munroe Island, distant less than half a mile, shelters it on the east and southeast. The outer part of the harbor is exposed in a northeasterly direction only to the winds, which sweep diagonally across Penobscot Bay, but there is an area close in to shore which is protected from winds and seas even in that direction.

Owls Head Bay is a narrow stretch of water between the west shore and Munroe Island. It is estimated that more than 20,000 vessels pass through it annually.

Formerly vessels bound for Rockland sought shelter from easterly storms in Owls Head Harbor, because Rockland Harbor was fully exposed, but since the Government has constructed the breakwater at Rockland this is no longer necessary. Rockland Harbor is itself now an excellent harbor of refuge from easterly storms.

The improvement desired at Owls Head is the enlargement of the harbor by the construction of a breakwater from the easterly point of the mainland to a ledge known as Dodges Ledge, about 500 feet distant. * * *

It may be remarked that the Government some years ago expended $17,902 in constructing a breakwater here of wooden cribs filled with stone. Some of the latter still remains there, but the timber has disappeared. At that time there was no breakwater at Rockland, and a harbor to shelter from easterly storms was a necessity in the near vicinity. The status has now changed. The Rockland breakwater affords the best of shelter. South of Owls Head, and distant only 6½ miles, is another excellent harbor known as Seal Harbor. Thus Owls Head Harbor is between these two, distant 6½ miles in one direction and 2½ in the other. A sailing vessel can thus make a fair wind under any circumstances if a harbor of refuge is sought.

I am informed that many vessels still anchor in Owls Head Harbor, notwithstanding the fact that there is a better harbor only 2½ miles distant, but the Rockland breakwater was not until within the last few years sufficiently extended to be of much use. As mariners become accustomed *to the latter they will* seek it in preference to Owls Head,

except perhaps those that hail from the latter place; naturally they will prefer to anchor at Owls Head.

Nineteen vessels are reported to have broken from their moorings at Owls Head within the last eighteen years, but only one was wrecked, and in no case were any lives lost. Some drifted ashore and were afterward floated off; others proceeded on their journeys, losing their anchors only. These accidents might perhaps have been avoided if the vessels had been provided with good ground tackle. One other vessel was wrecked here, but she was run on to Dodges Ledge in broad daylight. Breakwaters, be they ever so numerous, can not give protection from the consequences of such stupidity.

The natural harbor at Owls Head is a good one without any breakwater, but the protected area is comparatively small. If it were proposed to enlarge it, I am of the opinion that a better location for the breakwater would be a short distance to the southward. The location formerly chosen was the most economical one, but it added little to the protected area.

I am of the opinion, however, that the natural harbor is large enough for all practical purposes at the present time, and that vessels provided with good anchors and chains will have no difficulty in riding out an easterly gale. Moreover, the number of vessels that anchor there for refuge will grow less and less each year as the advantages of Rockland become better known. The breakwater at the latter place is not yet half finished, and, in my opinion, it is better for the Government to apply all the money it is proposed to expend on breakwaters in this vicinity to that at Rockland.

In view of the above, I am of the opinion that Owls Head Harbor, Maine, is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 29.

PRELIMINARY EXAMINATION OF TENNANT HARBOR, MAINE.

[Printed in House Ex. Doc. No. 101, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report dated October 18, 1892, from Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Tennant Harbor, Maine, made to comply with requirements of the river and harbor act approved July 13, 1892.

Lieut. Col. Hains states that in his opinion the harbor is not worthy of improvement by the General Government, and I concur in this opinion of the local engineer.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 18, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Tennant Harbor, Me., and have the honor to submit the following report:

Tennant Harbor is located on the west side of the entrance to Penobscot Bay, about 10 miles south of Thomaston. On the Coast Survey charts it is shown as a village at the end of the arm of the bay, extending westward from Southern Island. I was informed, however, that Tennant Harbor includes an arm of the bay to the northeastward, called Long Cove. Taken to include the latter, Tennant Harbor is a place of some importance, both as a harbor of refuge in stormy weather and as a shipping point for granite, considerable quantities of which are quarried in this vicinity. During the year 1891 the three principal granite companies shipped about 27,500 tons of granite, consisting of rough dimension stone, grout, and paving stones. During the past season the amount has been much less, owing to the strike of the stone-cutters. It is estimated that about 30,000 tons of granite would be a fair year's shipment. There is also a small quantity of ice shipped, say about 500 to 600 tons. The total value of shipments may be stated at about $125,000 annually.

I was informed that about 3,000 tons of coal are brought there for consumption in the quarries. As a rule, however, vessels come to Tennant Harbor light.

Tennant Harbor is sometimes sought as a harbor of refuge in northeasters, it being easy of access and well protected; besides, it is generally clear of ice in the winter.

A small steamer that runs from Rockland south touches here, carrying passengers and miscellaneous freight.

Mr. Hall, the deputy collector of the port, estimates that fully 2,000 vessels, including those that seek it as a harbor of refuge, visit Tennant Harbor annually.

I endeavored to find out what improvements were needed in behalf of navigation. I was informed that there was a wreck in Long Cove, just west of Clark Island, that obstructed navigation; that a breakwater was wanted between Southern Island and the mainland; and that the shoal known as Harts Ledge needed to be marked by a beacon.

I had an examination made of the wreck, and it was found that the stern lies in about 6 feet of water on the westerly edge of the channel following the upper shore of Clark Island, nearly opposite the wharf of the Long Cove Granite Company. The bow is several feet above high tide. Very few vessels use this channel, not more than five or six annually. The wreck is not an obstruction to navigation, but rather an aid, as it serves as a beacon to mark the ledge. It has been there for twenty years and its removal would not be a benefit to navigation.

In regard to the breakwater between Southern Island and the main land at Harts Neck, I am of the opinion that it is not needed. The steamer that touches at Tennant Harbor generally uses this passage. The depth at low tide is 3 feet, but the rise and fall being over 9 feet, it is seldom too shoal for her. Besides, the fishermen use it constantly and would object to its closure. It is claimed that the undertow in southeasters would be much reduced and the area of good anchorage increased, but an increased area for *anchorage is not* needed at the present time, and

the slight undertow in the harbor is a trifling matter, dangerous neither to life nor property, and can easily be avoided altogether by anchoring well to the westward or going into Long Cove.

In regard to the need of a beacon on Harts Ledge it may be remarked that Harts Ledge is not located in any part of Tennant Harbor. It lies about a mile south of Tennant Harbor light, and the question of properly marking it belongs to another department of the Government.

In view of the above I am of the opinion that Tennant Harbor, Maine, is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 30.

PRELIMINARY EXAMINATION OF GEORGES RIVER, MAINE.

[Printed in House Ex. Doc. No. 58, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report dated October 17, 1892, by Lieut. Col. Peter C. Hains, Corps of Engineers, of the results of a preliminary examination of Georges River, Maine, made to comply with provisions of the river and harbor act approved July 13, 1892.

Lieut. Col. Hains is of opinion that the river as far as Thomaston is worthy of improvement by the General Government, and that it will require $1,200 to make the surveys necessary to the preparation of plan and project with estimate of cost of improvement proposed.

I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen. Chief of Engineers.

HON. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland Me., October 17, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Georges River, Maine, and have the honor to submit the following report:

Georges River, sometimes called St. Georges River, is a deep tidal stream nearly up to Thomaston. Three and a half fathoms can be carried to within a mile of that town. Near the town itself the channel becomes narrow, and at one place there is a sharp bend which it is difficult to pass through on account of the swiftness of the cross currents.

Thomaston was formerly the center of a large shipbuilding industry. Some of the largest American sailing clippers were built here. This industry has greatly fallen off; still there are many sailing ships that were built, and are still owned in Thomaston, though they seldom visit that port except for repairs.

Large quantities of lime are manufactured and shipped from here. This is a bulky article of commerce, and gives constant employment, it is said, to no less than thirty vessels of from 150 to 500 tons capacity. The amount of lime shipped the past year, which is rather under the average, is put at over 300,000 barrels, valued at about $250,000.

The manufacture of lime creates a large demand for coal and cord wood. It is estimated that not less than 10,000 tons of coal and 15,000 cords of wood are received. The importation of wood gives employment to a large number of small sailing vessels, as the most of it comes from the Dominion of Canada. The exports and imports from the river above Thomaston would add considerably to the above, but no account of that is taken.

The improvement desired is the deepening and straightening of the channel in front of the town and in the bend already referred to. When a vessel goes ashore it is apt to cause a leak, and a leak in one loaded with lime is a serious matter, resulting in the almost certain loss of the cargo, and the probable destruction of the vessel. Two vessels are reported to have met with such an accident recently by being swept ashore at the bend by the swiftness of the current. One of them was lost by fire, and the other had to be scuttled to save her.

* * * * * * *

In view of the above I am of the opinion that Georges River, Maine, is worthy of improvement up as far as Thomaston, and I recommend that a survey be made, the estimated cost of which is $1,200.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieutenant Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

A 31.

PRELIMINARY EXAMINATION OF PORTLAND HARBOR, MAINE, WITH A VIEW TO EXTENDING THE CHANNEL ALONG THE FRONT OF THE WHARVES ON THE SOUTH SIDE OF THE HARBOR, SO AS TO GIVE A DEPTH OF 8 FEET AT MEAN LOW WATER AS FAR SOUTH AS THE PLUSH MILL WHARF.

[Printed in House Ex. Doc. No. 102, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated November 19, 1892, by Lieut. Col. P. C. Hains, Corps of Engineers, upon preliminary examination of Portland Harbor, Maine, with a view to extending the channel along the front of the wharves on the south side of the harbor, so as to give a depth of 8 feet at mean low water

as far south as the Plush Mill Wharf, made to comply with requirements of the river and harbor act approved July 13, 1892.

Col. Hains states that he is of the opinion that Portland Harbor is not worthy of improvement by the General Government in the manner specified, and I concur in this opinion.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., November 19, 1892.

GENERAL: In compliance with requirements of Department letter of July 14, 1892, I have made a preliminary examination of Portland Harbor, Maine, "with a view to extending the channel along the front of the wharves on the south side of the harbor, so as to give a depth of 8 feet at mean low water as far south as the Plush Mill Wharf," and have the honor to submit the following report:

The commercial importance of Portland Harbor is well known. The General Government has recognized this in expending large sums on the improvement of its channels and the construction of a breakwater. No dredging, however, has been done on the south side of the harbor, as no necessity for it has existed. A few wharves have been built, but those west and south of the Marine Railway are cheap structures which, for lack of use, have been allowed to go to ruin.

From the Ferry Wharf westward the shore line recedes from the channel until it approaches the bridge, near which is a deep indentation or cove. In front of this shore line is a large area of flats. I am informed that various projects for filling these flats have been considered, but none adopted, though the idea seems never to have been definitely abandoned. They remain as they long have been, nearly bare at low tide. As the mean rise and fall of the tide is about 9 feet, there is about that depth on them at high tide. This depth is not sufficient, however, for vessels of any size.

The Plush Mill Wharf, located about half a mile west of the Ferry Wharf, is a cheap, temporary structure, built on wooden piles. It is 31 feet wide and 214 feet long, widened to 47 feet at the outer end. The wharf is located on the flats referred to, so that the approaches to it are impracticable except when the tide is in. It was built, however, within the last year, during which time the conditions have in no degree changed.

I am informed that besides the plush mill there are other manufactories likely to be established on the south side of the harbor, which, it is alleged, will give employment to a large number of operatives and require the consumption of large quantities of coal and other supplies. What prospect there is of the realization of these anticipations I am not able to say, but at the present time the plush mill is the only one in existence, and it is not yet in operation.

I have not been able to obtain any reliable data as to the amount of coal and supplies that will be needed, but I am informed that the amounts will be large. The plush mill itself is not a large establish-

ment, and unless other industries spring up, of which there is as yet no visible evidence, I can not see what will create this large demand. The excavation of the channel referred to will not, in my opinion, do it. Under the circumstances it is not practicable to make a reasonably fair estimate of the prospective demands of commerce on this side of the harbor. These will depend entirely on the developments of the future. That the immediate demands are quite small is evident. I have been in communication with persons interested in the development of this locality, but I have not been able to obtain any tangible data to show the necessity for such improvement.

I do not understand that a channel such as the order for examination contemplates is needed for the accommodation of vessels other than those that will go to the Plush Mill Wharf. There are in fact no others west of the marine railway; there are only the ruins of two pile structures that once were wharves.

In 1882, by authority of the legislature of the State, harbor lines were established for Portland Harbor. That on the south side is a straight line from the Ferry Wharf to the Portland Bridge, and passes about 100 feet outside of the existing dry dock. The Plush Mill Wharf is so located that its outer end does not come within 1,000 feet of this harbor line. Hence to extend the channel south to the Plush Mill Wharf will carry it far inside the duly-established harbor line. In this connection it is perhaps not improper to call attention to section 5 of the river and harbor act of 1892, which provides—

That no money appropriated for the improvement of rivers and harbors in this act or hereafter shall be expended for dredging inside of harbor lines duly established.

* * * * * * *

In view of the above I am of the opinion that Portland Harbor, Maine, is not worthy of improvement by the General Government in the manner specified in the order for examination, viz:

With a view to extending the channel along the front of the wharves on the south side of the harbor, so as to give a depth of 8 feet at mean low water as far south as the Plush Mill Wharf.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Newburyport Harbor, Massachusetts.
2. Merrimac River, Massachusetts.
3. Powow River, Massachusetts.
4. Ipswich River, Massachusetts.
5. Essex River, Massachusetts.
6. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.
7. Gloucester Harbor, Massachusetts.
8. Manchester Harbor, Massachusetts.
9. Salem Harbor, Massachusetts.
10. Lynn Harbor, Massachusetts.
11. Winthrop Harbor, Massachusetts.
12. Mystic and Malden rivers, Massachusetts.
13. Boston Harbor, Massachusetts.
14. Weymouth River, Massachusetts.
15. Hingham Harbor, Massachusetts.
16. Scituate Harbor, Massachusetts.
17. Plymouth Harbor, Massachusetts.
18. Kingston Harbor, Massachusetts.
19. Wellfleet Harbor, Massachusetts.
20. Provincetown Harbor, Massachusetts.
21. Chatham Harbor, Massachusetts.

EXAMINATIONS.

22. Gloucester Harbor, Massachusetts.
23. Vincent Cove, Gloucester Harbor, Massachusetts.
24. Saugus River, Massachusetts.
25. Chelsea River, Massachusetts.
26. East Boston Channel, Massachusetts.
27. Neponset River, Massachusetts.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 6, 1893.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1893.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 1.

IMPROVEMENT OF HARBOR AT NEWBURYPORT, MASS.

Newburyport is situated on the south bank, 2½ miles, approximately, from the mouth of the Merrimac River. The river empties into the Atlantic Ocean midway between Cape Ann and Portsmouth, or about 30 miles a little east of north from Boston in a direct line.

The outlet of the river between Plum Island and Salisbury Point is 1,000 feet wide and 30 feet deep at mean low water. At a distance of nearly a mile outside lies a sandy bar, thrown up by wave action through which, previous to the improvement, a channel, variable in position, direction, and depth, was maintained by the current of the river, increased by the tidal prism in a large interior basin, due to a range of tides equaling 7½ feet.

For 1,000 feet outward from the gorge towards the crest of the bar the current was able to maintain a channel of navigable width and 18 feet deep at mean low water, and for a further distance of 1,500 feet a channel 12 feet deep. From the 18-foot contour line on the inside to the same on the outside the distance was 4,000 feet, and between the 12-foot contours the distance was 3,000 feet.

The depth on the crest of the bar was generally less than 7 feet at mean low water.

The object of the improvement is to create through the outer bar a channel 1,000 feet wide and at least 17 feet deep at mean low water, so that vessels may cross the bar and find a harbor at any stage of the tide with as great draft as can reach Newburyport by the river at high tide.

The project submitted September 16, 1880, proposed two converging rubblestone jetties, their outer ends parallel for 1,000 feet and about the same distance apart, and the protection of the beach in their vicinity. This was modified in 1882, so as to provide for the partial closing of Plum Island Basin, with a timber dike, about 800 feet long and 5½ feet above mean low water.

The direction of the south jetty and the character of the shore protection was modified in 1883. The north jetty, from Salisbury Beach, is to be 4,000 feet long, approximately, and the south jetty, from Plum Island, is to be 2,400 feet, approximately.

Both are 15 feet wide on top, which is in a plane 12 feet above mean low water. The two jetties have slopes of 1 on 2 on the sea side and 1 on 1 on the harbor side.

A map showing the location of the jetties is published in the Annual Report of the Chief of Engineers for 1885. Their form and dimensions are shown in the report for 1881. The location and details of construction of the dike are given in the report for 1883. The estimated cost of the improvement was $375,000.

The total appropriations to date are $277,500.

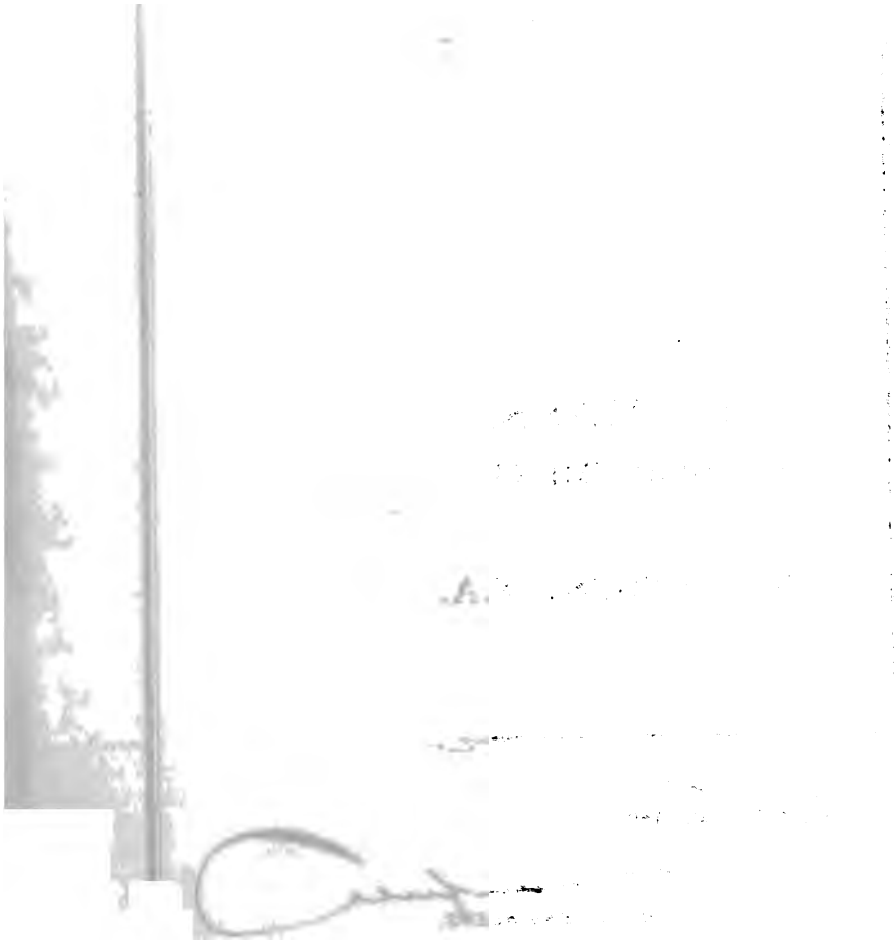
The amount expended to June 30, 1892, was $251,023.79.

On June 30, 1892, the condition of the improvement was as follows: The north jetty was completed for a length of 2,485 feet, and partly completed for 190 feet in addition; the south jetty was completed 1,077 feet, and partly completed for an additional length of 223 feet, and its shore end was strengthened by a sand catch; the dike had been completed so far as was prudent for its safety; it is 817 feet long, 5½ feet high above mean low water, except that near its center a weir had been left, 150 feet long, its sill 2 feet above mean low water.

On July 18, 1892, it was proposed to expend the available funds in extending the full section of the north jetty. This recommendation was approved July 22, 1892.

On August 5, 1892, an advertisement was issued calling for proposals for the deposit of rubblestone in the north jetty. The bids received were opened September 9, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with Mr. Geo.




30
40
0
1000
2000
6000

st Andrews, of Biddeford, Me., to deposit in the north jetty 15,000 of rubblestone.

erations under this contract were commenced in May, 1893, and e close of the fiscal year 669 tons of stone had been placed in the t jetty, essentially completing 25 feet of its length.

ring the latter part of May, 1893, a survey of the bar was made. ows, by comparison with the survey of 1892, that the entrance nel has straightened and swung slightly to the southward. The st channel is at least 300 feet wide, and the depth on the bar is feet. The outside contours show no essential change. Inside the e the channel has deepened and shows a decided change for the r.

the date of this report the north jetty is 2,510 feet long, fully leted, and partly completed for an additional length of 165 feet. outh jetty and the dike are in the same condition as on June 30,

om notes furnished by Mr. Hiram F. Mills, engineer of the Essex pany at Lawrence, Mass., it is seen that the spring freshet in the imac River this year was of slightly more than the average in tion and height.

complete the improvement an appropriation of $97,500 will be re- d, all of which could be expended to advantage during the fiscal ending June 30, 1895, in the extension of both jetties to their full cted lengths.

e advantages to be derived from the completion of the project are leepening and widening of the channel across the bar, thereby af- ng a harbor of refuge on the inside of Salisbury Beach and giving access at high tide to the wharves at Newburyport for vessels ing 17 feet, approximately.

e work is located in the collection district of Newburyport, Mass., of which uryport is the port of entry. The nearest light-house is on Plum Island, at the ce of the harbor.

e accompanying commercial statistics for the fiscal year have been ished by the collector of customs for Newburyport, Mass.

e dates and amount of appropriations for this work are as follows:

f—		Act of—	
ne 14, 1880	$50,000	August 11, 1888	$25,000
arch 3, 1881	40,000	September 19, 1890	25,000
ugust 2, 1882	40,000	July 13, 1892	20,000
ly 5, 1884	40,000		
ugust 5, 1886	37,500	Total	277,500

Money statement.

1, 1892, balance unexpended		$6,476.21
nt appropriated by act approved July 13, 1892		20,000.00
		26,476.21
30, 1893, amount expended during fiscal year		818.08
1, 1893, balance unexpended		25,658.13
1, 1893, outstanding liabilities	$1,112.04	
1, 1893, amount covered by uncompleted contracts	22,786.29	
		23,898.33
1, 1893, balance available		1,759.80
ount (estimated) required for completion of existing project		97,500.00
ount that can be profitably expended in fiscal year ending June 30, 1895		97,500.00

mitted in compliance with requirements of sections 2 of river and rbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for the delivery of rubblestone in the north jetty at Newburyport, Mass., opened September 9, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for stone per ton of 2,000 pounds.	Total tons can be delivered at price.	Remarks.
1	George Willet Andrews, Biddeford, Me	$1.59	15,094	Lowest bid.
2	Rockport & Pigeon Hill Granite Co., Rockport, Mass	1.91	12,617	
3	Joseph H. White, Boston, Mass	1.69	14,201	

The contract was awarded to Mr. George Willet Andrews, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1890, $1,955.68; 1892, $364.96; 1893, $918.01.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	8	892	8	387	2	146
Domestic						
Clearances:						
Foreign	8	913	4	485	13	2,362
Domestic	4	780	16	4,085	1	399

Imported.	1891.	1892.	1893.
Coal	1,470	563	
Lumber		*135,000	*34,280
Lath			†98,600
Miscellaneous	190		115

*Feet. †In number.

Average draft of vessels entering the harbor is 10 feet; maximum draft 15 feet. The coal business at this port is annually increasing, but there being no inspector, statistics can not be given.

B 2.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The mouth of the Merrimac River is 15 miles northwest from Cape Ann, Massachusetts. Tide water extends up it a distance of 19 miles, or to the foot of the "Upper Falls," 1½ miles above Haverhill, Mass.

Seven incorporated cities and the largest mills in New England are directly interested in this improvement.

Before improvement the channel was narrow and crooked, and much obstructed by ledges, bowlders, and shoals.

At mean low water vessels drawing not to exceed 7 feet could enter the river and proceed to South Amesbury, 9 miles from the mouth. The sea bar at the mouth of the river has been improved under specific appropriations for the improvement of Newburyport Harbor, while many sunken rocks and wrecks of piers and vessels lying inside the bar have been removed by general appropriations for the improvement of the river.

The object of the improvement is to straighten, widen, and deepen the natural channel of the river from the bar to the head of tide water.

The rise or fall of the tide at the mouth is 7.7 feet; at Haverhill Bridge, 4 feet.

No plan of the river above Newburyport has been published in the reports of the Chief of Engineers.

This project originally adopted in 1870 proposed to remove obstructions from the Upper and Lower Mitchells Falls, and to remove the Gangway Rock and the "Boilers" in Newburyport Harbor.

The cost was estimated to be $69,025.

The project was modified in 1874 so as to include the removal of rocks in and near the draw of the bridge at Deer Island, 2 miles above Newburyport, and at Rocks Bridge, and at Little Curriers Shoal, East Haverhill, so that the channel should have the following depths at ordinary high-water stages of the river: From the mouth to Deer Island Bridge, 5 miles, 16½ feet; thence to Haverhill Bridge, 12½ miles, 12 feet; thence to the foot of Mitchells Falls, Hazeltine Rapids, 1½ miles, 10 feet; thence through Mitchells Falls to the head of the Upper Falls, 2½ miles, not less than 4½ feet, when the mill water at Lawrence is running.

This revised project was estimated to cost $147,000.

The total appropriations to date have been $242,366.72.

The expenditures to June 30, 1892, were $230,876.20.

The excess of expenditures over the estimate is due to the removal of rocks and other obstructions that were unknown and removal not contemplated when the estimate was made and by the expense of necessary surveys and examinations not provided for in the estimate.

The condition of the improvement June 30, 1892, was as follows:

The modified project of 1874 was completed with the exception of the removal of the "boilers" upon which no work had been done.

The funds made available by the act of September 19, 1890, were appropriated for the improvement of Mitchells Falls, where their expenditure would produce no appreciable benefit to commerce.

The act of July 13, 1892, provided:

> That the amount appropriated in act of September 19, 1890, for improving Merrimac River at Mitchells Falls may be applied to the general improvement of the river in the discretion of the Secretary of War.

It was therefore proposed and approved to expend the available funds in the completion of the project by the removal of the "boilers" to a depth of 5 feet at mean low water.

On August 6, 1892, an advertisement was issued calling for proposals for the removal of 350 cubic yards of ledge from the "boilers." The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 21, 1892, a contract was entered into with Messrs. Sturgis and Andrews of Bonny Eagle, Me., to remove this ledge.

Operations under this contract were commenced in October, 1892, were suspended during the months December, 1892, to April, 1893, owing to the severity of the weather and freshets in the river, and resumed in May, 1893.

At the close of the fiscal year 201 cubic yards of the ledge had been removed.

The funds available will suffice to complete the improvement to the head of Mitchells Falls.

To extend the improvement so that the same depth of water as is now

obtained through Mitchells Falls can be carried to Lawrence (a distance of 5 miles from the head of the falls) was in 1882 estimated to cost, for dredging through Gages Shoal and Andover Bar and removing bowlders and ledges, $11,000.

The improved channel is in good order.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the nearest port of entry. The nearest light-houses are the Plum Island lights and the Newbury Upper Harbor lights.

Commercial statistics are included in statement for Newburyport Harbor.

No increase of the tonnage of the river is apparent since the improvement was commenced, and no new lines of water transportation have been established.

The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
May 23, 1828	$32,100.00	June 18, 1878	$10,000.00
April 2, 1830	3,506.72	March 3, 1879	5,000.00
March 2, 1831	16,000.00	June 14, 1880	12,090.00
March 2, 1833	4,900.00	March 3, 1881	9,000.00
June 28, 1834	3,860.00	August 2, 1882	9,000.00
July 11, 1870	25,000.00	July 5, 1884	3,500.00
March 3, 1871	25,000.00	September 19, 1890	10,000.00
June 10, 1872	25,000.00	July 13, 1892	1,500.00
March 3, 1873	25,000.00		
June 23, 1874	10,000.00	Total	242,366.72
March 3, 1875	12,000.00		

Appropriations made since 1870 have been expended on the approved project of that date and its modifications.

Money statement.

July 1, 1892, balance unexpended		$9,990.52
Amount appropriated by act approved July 13, 1892		1,500.00
		11,490.52
June 30, amount expended during fiscal year		2,399.00
July 1, 1893, balance unexpended		9,091.52
July 1, 1893, outstanding liabilities	$1,484.72	
July 1, 1893, amount covered by uncompleted contracts	2,091.35	
		3,576.07
July 1, 1893, balance available		5,515.45

Abstract of proposals for removal of ledge from Merrimac River, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid per cubic yard measured in situ.	Total.	Remarks.
1	Edgar P. Lovering, South Boston, Mass	$16.90	$5,915.00	
2	Hiram W. Phillips, Quincy Point, Mass	37.00	12,950.00	
3	Herbert H. Sturgis, Bonney Eagle, Me., and Solon S. Andrews, Gorham, Me	13.85	4,847.50	Lowest bid.
4	George W. Townsend and John Olsen, Boston, Mass	19.00	6,650.00	

The contract was awarded to Messrs. Sturgis & Andrews, with the approval of the Chief of Engineers.

B 3.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

Powow River is a tributary of the Merrimac River, which it joins from the north about 3½ miles above Newburyport. The tide enters the river a distance of about 9,600 feet, following the channel, or to a dam just above the town of Amesbury, Mass.

The present channel is narrow, exceedingly crooked, and is not navigable at low water. The mean range of the tide at the mouth of the river is 6.7 feet.

The general project for the improvement of the river was proposed January 24, 1885. It was based on the survey provided for in the act of July 5, 1884.

This project proposed to make a channel 9,600 feet long, 60 feet wide on the bottom, and 12 feet deep at mean high water at an estimated cost of $77,000.

Three appropriations have been made for this improvement, viz, by the act of August 11, 1888, which appropriated $3,000 for dredging, provided that this sum shall not be expended until the towns of Amesbury and Salisbury, or either of them, shall have caused such a draw to be placed in the present bridge over said river as may be approved by the Secretary of War; by the act of September 19, 1890, $5,000, with a similar proviso; and by act of July 13, 1892, $4,000. On April 10, 1889, the Secretary of War approved the plan of the proposed bridge.

On May 11, 1892, the chairman of the selectmen of the town of Amesbury, Mass., stated that the bridge over the Powow River had been reconstructed in accordance with the approved plans.

The available funds are insufficient to afford any appreciable benefit to commerce by their expenditure, and they will be retained in the Treasury until additional funds are provided.

To complete this improvement will require an appropriation of $65,000. Of this amount $30,000 could be expended to advantage during the fiscal year ending June 30, 1895.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the nearest port of entry. The nearest light-houses are the Newburyport Upper Harbor lights.

Commercial statistics are included in the statement for Newburyport Harbor. No increase in the tonnage of the river is apparent, and no new lines of water transportation have been established.

Money statement.

July 1, 1892, balance unexpended	$8,000.00
Amount appropriated by act approved July 13, 1892	4,000.00
	12,000.00
July 1, 1893, balance unexpended	12,000.00
Amount (estimated) required for completion ef existing project	65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

B 4.

IMPROVEMENT OF IPSWICH RIVER, MASSACHUSETTS.

Ipswich River empties into Plum Island Sound 9 miles south of Newburyport, Mass., and at the same distance west of Cape Ann. The head of navigation is 3 miles above the mouth.

The entrance of Plum Island Sound is 7 miles east of the mouth of the river. Six feet depth at mean low water can be carried over the bar at the entrance to the sound, and between the bar and the mouth of the river there is a good anchorage, with from 3 to 5 fathoms of water.

Before improvement the channel of the river from its mouth to Barras Turn, a distance of 2 miles, was at least 60 feet wide and 4 feet deep at mean low water. From Barras Turn to the town wharves, a distance of 1 mile, the channel was narrow and crooked, and had at some places but 1½ feet depth at mean low water. The rise or fall of the tide is 8.4 feet.

The original project for improvement was submitted December 6, 1875. It proposed a channel 60 feet wide and 4 feet deep at mean low water from Barras Turn to the town wharves, at an estimated cost of $25,000.

On November 5, 1883, the original project was divided into three partial projects:

1. The removal of the ledges at Heards Point and opposite Nabbys Point to a depth of 2 feet at mean low water, to open a navigable channel of that depth, at a cost of $15,900.

2. To dredge the shoals at Labor in Vain and The Shoals so as to open a channel 4 feet deep at mean low water and 60 feet wide, at a cost of $2,200.

3. To straighten the channel by making a cut across Barras Turn, and to build a jetty to close the old channel, at a cost of $6,900.

In the Annual Report of 1887, it was recommended that the general project be modified by limiting the present improvement to opening a channel 60 feet wide and 4 feet deep through The Shoals and Labor in Vain, and extending it to the deep hole opposite the town wharves.

A chart showing this limited project was published in the Report of the Chief of Engineers for 1887.

The amount which has been appropriated for this work to date is $7,500.

The amount expended to June 30, 1892, was $2,537.08.

On June 30, 1892, a channel had been dredged 4 feet deep at mean low water, 60 feet wide at Labor in Vain, and 40 feet wide at The Shoals.

On July 18, 1892, it was recommended that the available funds be expended in completing the partial project of 1887. The recommendation was approved July 22, 1892.

On August 8, 1892, an advertisement was issued calling for proposals for the proposed dredging.

The bids received were opened September 8, 1892, and an abstract of them will be found in the annexed table.

On September 17, 1892, a contract was entered into with Mr. Edgar P. Lovering, of South Boston, Mass., to remove by dredging 6,000 cubic yards.

No operations were in progress during the fiscal year under this contract, and the condition of the improvement at the date of this report is the same as on June 30, 1892.

To complete the original project would require an appropriation of $17,500, but the present proposed partial project, it is believed, will fully meet all the reasonable demands of the commerce of the river, and the available funds will suffice for this purpose.

Ipswich River is in the collection district of Newburyport, Mass. The nearest light-house is the Ipswich Light on Castle Neck, about 1½ miles southeast from the mouth of the river.

Commercial statistics are included in the statement for Newburyport Harbor.

No increase in the tonnage of the river is apparent and no new lines of water transportation have been established.

The dates and amounts of appropriations for this work are:

By act of—	
August 5, 1886	$2,500
August 11, 1888	2,500
July 13, 1892	2,500
Total	7,500

Money statement.

July 1, 1892, balance unexpended	$2,462.92
Amount appropriated by act approved July 13, 1892	2,500.00
	4,962.92
June 30, 1893, amount unexpended during fiscal year	19.21
July 1, 1893, balance unexpended	4,943.71
July 1, 1893, amount covered by uncompleted contracts	2,100.00
July 1, 1893, balance available	2,843.71

Abstract of proposals for dredging from Ipswich River, Massachusetts, opened September 8, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards can be moved at price.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons' weight.		
		Cents.	*Dollars.*		
1	Augustus B. Martin, Boston, Mass	73	10	5,890	
2	Edgar B. Lovering, South Boston, Mass	35	7	12,285	Lowest bid.
3	Augustus R. Wright, Portland, Me	75	3	5,733	
4	Chas. H. Souther, Boston, Mass	90	18	4,777	

The contract was awarded to Mr. E. B. Lovering, with the approval of the Chief of Engineers.

B 5.

IMPROVEMENT OF ESSEX RIVER, MASSACHUSETTS.

Essex River winds between marshy banks for 3½ miles from the head of navigation, at the village of Essex, to its mouth, which forms a harbor of refuge for light-draft vessels, about 3 miles to the southeastward of the entrance to Ipswich Harbor, Massachusetts.

The channel of the river is crooked and obstructed by sand bars and bowlders.

The project for its improvement was submitted May 15, 1891. It proposed to widen and deepen the upper 12,000 feet of the natural channel of the river, so that 4 feet at mean low water could be carried to the head of navigation in a channel 60 feet wide, at a cost, as estimated, of $25,000.

But one appropriation for this work has been made, viz, by the act of July 13, 1892, $5,000.

On July 18, 1892, it was recommended that the available funds be retained in the Treasury until an additional appropriation is made, for the reason that no appreciable benefit to commerce would result from the expenditure of so small a sum. This recommendation was approved August 4, 1892.

No other operations were in progress during the fiscal year, and at the date of this report the original condition of the river is unaltered.

To complete the improvement will require an appropriation of $20,000, all of which could be expended to advantage during the fiscal year ending June 30, 1895.

Essex River is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Annisquam Light, 2 miles east of the mouth of the river.

Commercial statistics are included in the statement for Gloucester Harbor, Massachusetts.

Money statement.

Amount appropriated by act approved July 13, 1892	$5,000.00
July 1, 1893, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

B 6.

HARBOR OF REFUGE, SANDY BAY, CAPE ANN, MASSACHUSETTS.

Sandy Bay is situated at the northeastern extremity of the promontory of Cape Ann, which forms the northern limit of Massachusetts Bay. The shore lines of the bay form a little less than a right angle, and their directions are nearly north and south and east and west. The rocky island of Straitsmouth forms the eastern extremity of one shore line and the steep headland of Andrews Point the northern end of the other. Following the line of the proposed breakwater, the bay is 2¾ miles wide, and it has a depth of 2 miles, approximately.

The bay on the land side is perfectly protected by steep, high hills, but it fronts the northeast and is open to the full force of the violent northerly and easterly gales of this coast.

The great seas of the ocean are broken, however, in a degree by the sunken rocky ledges called Averys Ledge, the Dry and Little Salvages, the Flat Ground, and Abners Ledge, which are directly at the mouth of the bay. Inside these entrance ledges the bay is entirely unobstructed and has an average depth of 50 feet at mean low water.

A plan of the bay showing the proposed breakwater was published in the Annual Report of the Chief of Engineers for 1892, p. 564.

The original project for improvement was submitted in 1884. It proposed a continuous breakwater 9,000 feet long, divided into two branches; one starts at Averys Ledge and runs in a direction a little

west of north to Abners Ledge, a distance of 3,600 feet; the other extends 5,420 feet from Abners Ledge in a northwesterly direction and terminates at the 84-foot contour off Andrews Point.

The axis of the proposed breakwater is approximately at the inner edge of the ledges at the entrance of the bay and about 1 mile inside the Salvages and Flat Ground, which receive the first shock of easterly storm waves.

The southern entrance to the proposed harbor lies between Straitsmouth Island and Averys Ledge, and is to be 1,800 feet wide and at least 30 feet deep. The northern entrance near Andrews Point is 2,700 feet wide and 80 feet deep. They are so located with reference to each other that vessels can enter and leave the harbor with any wind.

The harbor formed by the breakwater covers an anchorage of 1,377 acres, in which the depth exceeds 24 feet at mean low tide.

The original project proposed to build the substructure of the breakwater to the level of 22 feet below mean low water of a mound of rubblestone, 40 feet wide on top.

On March 2, 1892, the project was modified to include the entire breakwater by a report of the special board of engineers constituted for that purpose.

This project was approved March 17, 1892, and it proposes to construct the entire breakwater of rubblestone with the following section: On the sea side, from the bottom to 15 feet below mean low water, a slope of 1 on $1\frac{1}{2}$; thence to mean low water, 1 on 3; thence to 18 feet above mean low water, 1 on 1; the width on the crest, 20 feet; and the rear slope 1 on $\frac{7}{10}$ to mean low water; thence to the bottom, 1 on 1.

The axis of the eastern branch of the breakwater is indicated by an iron spindle on Averys Ledge when in range with the south light-house on Thatchers Island. Cross ranges are established by iron pipes let into the rocks on Dry and Little Salvages, which mark points at intervals of 100 feet from the spindle (initial point) on Averys Ledge. The axis of the north branch is cross range 3640.

The estimated cost of the improvement is $5,000,000, to which must be added $2,500,000 for buoyage, lighting, and defense of the harbor.

These estimates are based upon consecutive annual appropriations of not less than 10 per cent of the original estimates of cost.

Should operations be suspended at any time from want of funds, or annual appropriations be reduced to small sums for a series of years, the expenses for the final construction will be proportionately increased.

The total appropriations to date are $600,000.

The expenditures, not including outstanding liabilities, to June 30, 1892, were $399,341.89.

On June 30, 1892, 515,688 tons of rubblestone had been deposited in the breakwater, essentially completing the substructure to a grade 22 feet below mean low water between cross ranges 140 and 4740.

During the fiscal year 22,246 tons of stone were deposited in the breakwater, under a contract dated December 4, 1890, with the Rockport and Pigeon Hill Granite Companies, thus completing this contract satisfactorily.

On July 18, 1892, it was recommended that the available funds be expended in completing so much of the full section of the breakwater as was possible, starting at Abners Ledge and working southward. This project was approved July 22, 1892.

On August 5, 1892, an advertisement was issued calling for proposals for the deposit of stone in the breakwater.

The bids received were opened September 9, 1892, and an abstract of them will be found in the annexed table.

On September 30, 1892, a contract was entered into with the Rockport and Pigeon Hill Granite Companies to deposit 14,000 tons of "large" stone and 120,000 tons of "small" stone in the breakwater, or sufficient, as estimated, to complete 400 feet of the full section.

The "small" stone are to consist of blocks, of which one-fourth must weigh not less than 4 tons each; one-half must average 2 tons each; and one-fourth must weigh from 50 to 1,000 pounds each. They are to be deposited so as to form the approved section of the breakwater to the grade of low water. Above low water the "large" stones will be carefully placed. They are to be blocks the largest sizes furnished by the quarries, none less than 4 tons in weight, and to average 6 tons.

Operations under the contract of September 30, 1892, were commenced in October, 1892, and at the close of the fiscal year 53,139 tons of "small" stone, and 724 tons of "large" stone had been deposited between cross ranges 3640 and 3440, essentially completing this part of the substructure of the breakwater to the grade of mean low water, and also completing about 50 running feet of the superstructure.

The total number of tons of stone deposited in the breakwater to date is 591,797.

To complete the project will cost $4,400,000.

During the year ending June 30, 1895, $500,000 could be expended to advantage.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are increased safety to life and property, and a consequent reduction in freight and insurance.

Sandy Bay is situated in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Straitsmouth Light, on Straitsmouth Island, at the southern entrance of the bay.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by Mr. Charles S. Rogers, of Rockport, Mass.

The dates and amounts of the appropriations for this work are as follows:

Act of—	
July 5, 1884	$100,000
August 5, 1886	100,000
August 11, 1888	100,000
September 19, 1890	150,000
July 13, 1892	150,000
Total	600,000

Money statement.

July 1, 1892, balance unexpended		$50,658.11
Amount appropriated by act approved July 13, 1892		150,000.00
		200,658.11
June 30, 1893, amount expended during fiscal year		77,143.19
July 1, 1893, balance unexpended		123,514.92
July 1, 1893, outstanding liabilities	$13,562.82	
July 1, 1893, amount covered by uncompleted contracts	90,439.37	
		104,002.19
July 1, 1893, balance available		19,512.73
Amount (estimated) required for completion of existing project		4,400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for the deposit of rubblestone in the breakwater at Sandy Bay, Massachusetts, opened September 9, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for stone per ton of 2,000 pounds.		Total tons can be received at price bid.	Remarks.
		Large.	Small.		
1	Rockport and Pigeon Hill Granite Co's, Rockport, Mass.	$2.33	Cents. 89	16,000 tons large, 120,000 tons small.	Only bid.

Contract was awarded to the Rockport and Pigeon Hill Granite Companies, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Articles.		1891.	1892.	1893.
Shipped:				
Stone	tons	160,000	199,191	170,000
Received:				
Coal	tons	8,126	8,153	8,126
Wood	cords	490	160	490
Lumber	feet	200,000	300,000	250,000
Fish	pounds	2,340,000	3,115,000	2,340,000
Mackerel	barrels		1,000	
Fish sounds	pounds		20,000	
Lobsters	barrels	600	1,000	600
Cod oil	gallons	7,200	8,000	7,200
Medicine oil	do	4,700	4,000	4,700
Salt	hogsheads	1,000	1,200	1,000

B 7.

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASS.

This is the most important harbor between Boston and Portland, and is the principal resort for all New England fishing vessels. It is situated at the southeastern extremity of Cape Ann, 20 miles northeast from Boston. It is easily entered when the dangerous storms of this coast occur, and provides a secure, ample shelter for all classes of vessels, except from south winds, and from these a moderate extent of protected anchorage is afforded in the inner harbor.

It contains in the outer roadstead, the inner harbor, and in the channel connecting them sufficient deep water for the most liberal demands of commerce, but the inner harbor and channel are obstructed by bowlders, ledges, and shoals dangerous and inconvenient to shipping, and the outer harbor or roadstead is open to the action of all southerly winds.

A plan of the harbor was published in the Annual Report of the Chief of Engineers for 1887, p. 506.

The first project formed for improvement was submitted January 20, 1871, and was based on the survey provided for by act of July 11, 1870. (Report of Chief of Engineers, 1871, p. 869.) This project proposed the removal of certain bowlders from the inner harbor at a cost of $10,606.20, and the construction of a breakwater from Eastern Point

over Dog Bar to Round Rock Shoal, at an estimated cost of $494,148.65.

On November 10, 1884, Maj. C. W. Raymond, Corps of Engineers, by order of the Special Board of Engineers that was considering the subject of the Sandy Bay Breakwater, submitted a project for two breakwaters at the entrance of Gloucester Harbor, one to cost $752,000 on essentially the same site as that proposed in 1871, and a supplementary one through Normans Woe Rock, to cost $607,000.

This project and estimate are published in the Chief of Engineers' Report for 1885, p. 534.

On January 20, 1885, it was recommended, in accordance with act of July 5, 1884, that a survery of the inner harbor and of the reef off Muscle Point be made, and that Babson Ledge be removed to 21 feet at mean low water (Report of Chief of Engineers, 1885, p. 541.) In the annual report for this harbor for 1887, a general project for its improvement was submitted, based on the survey provided for by act approved August 5, 1886. (Chief of Engineers' Report, 1887, p. 500.) This project proposed to remove from the inner harbor 101½ cubic yards of rock known to exist, and to dredge 216,000 cubic yards, scow measurement, at an estimated cost of $65,000; and to construct the breakwater recommended in the project of 1884, that extends from Eastern Point to Round Rock Shoal, at an estimated cost of $752,000.

The total appropriations to date are $80,000.

The expenditures to June 30, 1892, were $36,692.37.

The condition of the improvement June 30, 1892, was as follows:

Clam Rock had been reduced from 1 foot to 9½ feet at mean low water; Pinnacle Rock from 8½ to 16½ feet, mean low water; rock off Pew's Wharf from 2 to 5 feet, mean low water; rocks off J. Friend's Wharf from 13 to 17 feet, mean low water. All of the above rocks were reduced to the level of the surrounding bottom. Babson Ledge had been reduced from 11 to 14 feet, mean low water.

No work had been done on the breakwater. Two channels had been dredged in Harbor Cove, approximately parallel to the heads of the wharves; the east channel was 550 feet long; the west, 1,000 feet long; both were 140 feet wide, 10 feet deep at mean low water, except over a small ledge uncovered by the dredging off Parmenter's Wharf. The main harbor had been improved as projected from its entrance near Fort Point to the steamboat wharf, so that 15 feet depth at mean low water can be carried, except over 4 small ledges uncovered by the dredging near the Halibut Company Wharf.

On July 18, 1892, it was recommended that the available funds be expended in completing the proposed dredging. This recommendation was approved July 22, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for the proposed dredging. The bids received were opened September 7, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with the National Dredging Company, of Wilmington, Del., to dredge 150,000 cubic yards from Harbor Cove and the main harbor, thus completing the proposed dredging.

Operations under this contract were commenced during the last week of June, 1893, but as no actual dredging was done the condition of the improvement is the same as on June 30, 1892.

To complete the improvement will require an appropriation of $752,000, of which $250,000 could be expended to advantage during the year ending June 30, 1895, in commencing the breakwater.

The prospective advantages to commerce by the completion of the improvement are greater facilities and safety in the movement of vessels in the harbor, and a more safe anchorage for vessels seeking protection from southerly gales.

Gloucester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-houses are Ten Pound Island Light, in the harbor, and Eastern Point Light, at its entrance.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Gloucester, Mass.

The dates and amounts of appropriations for this work are as follows:

Act of—	
June 10, 1872	$10,000
August 5, 1886	5,000
August 11, 1888	10,000
September 19, 1890	15,000
July 13, 1892	40,000
Total	80,000

Money statement.

July 1, 1892, balance unexpended	$3,307.63
Amount appropriated by act approved July 13, 1892	40,000.00
	43,307.63
June 30, 1893, amount expended during fiscal year	29.13
July 1, 1893, balance unexpended	43,278.50
July 1, 1893, amount covered by uncompleted contracts	34,500.00
July 1, 1893, balance available	8,778.50
Amount (estimated) required for completion of existing project	752,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Gloucester Harbor, Massachusetts, opened September 7, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Number of yards can be removed at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	National Dredging Company, Wilmington, Del.	23	$15	173,913	Lowest bid.
2	Charles H. Souther, Boston, Mass	29½	8	135,593	
3	Augustus R. Wright, Portland, Me	26	15	153,846	
4	Augustus B. Martin, Boston, Mass	29	15	137,931	

The contract was awarded to the National Dredging Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, $19,800; 1892, ——; 1893, $9,083.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	146	26,235	213	43,460	156	22,135
Domestic	30	6,000	25	2,700	9	1,490
Clearances:						
Foreign	138	23,500	189	25,700	145	18,021
Domestic	57	11,220	77	17,110	63	9,774

Imported.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
Coal	45,000	37,200	* 30,000
Salt	30,000	33,000	16,000
Lumber		200	† 288,000
Miscellaneous	8,100	8,500	500

* From coastwise ports. † Feet.

All classes of vessels frequent the harbor, from 5 to 1,500 tons. Greatest draft, 24 feet. Total number of vessels boarded during the year was 3,312, not including fishing vessels and boats.

B 8.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASS.

Manchester Harbor is situated about 5½ miles northeastward from the entrance of Salem Harbor, Massachusetts.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for 1888, Part I, p. 466.

The outer sheltered roadstead contains, approximately, 300 acres, with 5 fathoms of water.

The entrance channel from the roadstead to Proctors Point is everywhere at least 100 feet wide, at least 6½ feet deep at mean low water, and is unobstructed.

At the "Narrows," distant 1,400 feet inside of Proctors Point, the depth in the channel is reduced to 1½ feet at mean low water; thence, to the town wharves, a further distance of 2,500 feet, no low-water channel exists. Near the town wharves the channel is crossed by the Boston and Maine Railroad (eastern division), on a bridge which has a draw opening 28 feet wide.

The original project for the improvement of this harbor was submitted November 28, 1887. It was based on a survey provided for in the river and harbor act of August 5, 1886. It proposed to dredge a channel 60 feet wide, 4,000 feet long, and 4 feet deep at mean low water from Proctors Point to the town wharves, at an estimated cost of $14,300.

The total appropriations for this improvement to date have been:

By the act of—	
August 11, 1888	$2,500
September 19, 1890	5,000
July 13, 1892	6,800
Total	14,300

The expenditures to June 30, 1892, were $7,122.09. On June 30, 1892, the improved channel was 35 feet wide, 4 feet deep at mean low water from Proctors Point to the railroad bridge, a distance of 2,900 feet.

On July 18, 1892, it was recommended that the available funds be expended in completing the proposed improvement. This was approved July 22, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for the proposed work. The bids received were opened September 7, 1892, and an abstract of them will be found in the annexed table.

On September 17, 1892, a contract was entered into with Mr. Edgar P. Lovering, of South Boston, Mass., to dredge 22,222 cubic yards. No operations were in progress during the fiscal year under this contract, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

It is estimated that the available funds will complete the improvement.

Manchester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry; the nearest light-house is on Bakers Island, 2½ miles from Proctors Point.

The existing commerce is nominal and commercial statistics are included in the statement for Gloucester Harbor, Massachusetts.

Money statement.

July 1, 1892, balance unexpended	$377.91
Amount appropriated by act approved July 13, 1892	6,800.00
	7,177.91
June 30, 1893, amount expended during fiscal year	33.84
July 1, 1893, balance unexpended	7,144.07
July 1, 1893, amount covered by uncompleted contracts	5,999.94
July 1, 1893, balance available	1,144.13

Abstract of proposals for dredging from Manchester Harbor, Massachusetts, opened September 7, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards removed at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	Augustus B. Martin, Boston, Mass	47	$10	12,765	
2	Boynton Bros., Boston, Mass	52	10	11,538	
3	Edgar P. Lovering, South Boston, Mass	27	7	22,222	Lowest bid.
4	Augustus R. Wright, Portland, Me	50	8	12,000	

The contract was awarded to Mr. Edgar P. Lovering, with the approval of the Chief of Engineers.

B 9.

IMPROVEMENT OF HARBOR AT SALEM, MASS.

Salem Harbor is 12 miles to the northward of Boston, Mass. Fort Pickering Light marks its entrance between Winter Island on the west and Naugus Head on the east. The harbor is 1,750 feet wide at its entrance and 5,500 feet long between the 12-foot contours of opposite shores. It contains a well-sheltered, entirely unobstructed anchorage of about 110 acres, of a greater depth than 18 feet, mean low water. In front of the city are extensive flats, which make long wharves necessary to reach deep water. The principal wharves of the city are located on "South River," a small stream which formerly drained a tidal basin on the southwestern side of the city. This basin is now practically filled up by city improvements. The river is 3,000 feet long to the head of navigation at South or Lafayette Street Bridge. It is crossed by a highway bridge about one-fourth of a mile below the head of navigation, with a draw-opening 31½ feet wide. The width of the river varies from 300 feet at its mouth to 150 feet at the head of navigation.

Originally the greatest depth of continuous low-water channel was 0.8 feet.

The original project for the improvement of the harbor was submitted December 16, 1872. It was proposed to dredge a channel 1,730 feet long, 300 feet wide, 8 feet deep at mean low water, at an estimated cost of $32,000. This project was essentially completed 1873–'75.

The present project for the improvement of the harbor was submitted December 2, 1889. It was based on a survey provided for in the act of August 11, 1888. It proposed as follows:

To clean out the channel of approach to South River to the original dimensions as dredged in 1873–'75, viz, 300 feet wide at the entrance and 150 feet wide off Derby Wharf Light, 8 feet deep at mean low water; to extend this channel with the same depth, gradually reducing the width to 100 feet to near the inner end of Derby Wharf; and from this point to the head of navigation to excavate a channel 50 feet wide and 6 feet deep at mean low water.

The total length of channel to be improved was 5,100 feet, approximately, and its excavation would require the removal of 85,000 cubic yards of material, at an estimated cost of $28,000.

The total appropriations to date have been $53,000.

The expenditures to June 30, 1892, were $37,782.62.

On June 30, 1892, the improved channel was 50 feet wide, 8 feet deep to near the inner end of Derby Wharf, and thence to the head of navigation 6 feet deep at mean low water.

On July 18, 1892, it was recommended that the available funds be expended in completing the improvement. This was approved July 23, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for the proposed work.

The bids received were opened September 7, 1892, and an abstract of them will be found in the annexed table.

On September 17, 1892, a contract was entered into with Mr. Augustus R. Wright, of Portland, Me., to remove by dredging 40,000 cubic yards.

No operations were in progress during the fiscal year under this contract, and the condition of the improvement at the date of this report is the same as on June 30, 1892.

It is believed that the funds now available will complete the improvement as proposed.

Salem Harbor, including South River, Massachusetts, is in the collection district of Salem, Mass., of which Salem is the port of entry. The nearest light-house is Derby Wharf Light, Salem Harbor, Massachusetts.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Salem, Mass.

The dates and amounts of the appropriations for this improvement are as follows:

Act of—	
March 3, 1873	$15,000
June 23, 1874	10,000
September 19, 1890	14,000
July 13, 1892	14,000
Total	53,000

Money statement.

July 1, 1892, balance unexpended	$1,217.38
Amount appropriated by act approved July 13, 1892	14,000.00
	15,217.38
June 30, 1893, amount expended during fiscal year	18.58
July 1, 1893, balance unexpended	15,198.80
July 1, 1893, amount covered by uncompleted contracts	8,000.00
July 1, 1893, balance available	7,198.80

Abstract of proposals for dredging from Salem Harbor, Massachusetts, opened September 7, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards can be removed at price.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	National Dredging Co., Wilmington, Del	25	$15	50,000	
2	Charles H. Souther, Boston, Mass	25¾	6	44,660	
3	Augustus B. Martin, Boston, Mass	25	10	50,000	
4	Augustus R. Wright, Portland, Me	20	3	62,500	Lowest bid.

The contract was awarded to Mr. Augustus R. Wright, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected: 1891, $6,416.80; 1892, $3,611.62; 1893, $2,384.85.

Shipping.	1868.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	100	225,000	77	10,720	74	11,536
Domestic	598		10	2,356	2	148
Clearances:						
Foreign			75	11,123		6,820
Domestic			39	5,933		8,303

Imported.	1891.	1892.	1893.
Coal tons..	5,890	3,256	89
Lumber feet..	3,424	875,791	572,467
Shingles		3,323,000	
Laths		575,000	
Eggs doz..		1,074	
Firewood cords..		850	
Bark cords..		310	
Lime barrels..		1,000	
Railroad ties		4,624	

During the fiscal year ending June 30, 1893, there arrived at the port of Salem 1,546 vessels, with a tonnage of 374,229 tons. Of this number 659 vessels discharged 236,262 tons of cargo here, and 887 vessels with a tonnage of 137,967 tons put in for a harbor.

The merchandise discharged was as follows: Asphalt, 20 barrels; paving blocks, 2,026 tons; barrels, 1,000; piling, 46,500 feet; bricks, 30,000; plaster, 325 barrels; cement, 5,883 barrels; potatoes, 3,417 bushels; clay, 405 tons; powder, 80 boxes; coal, 355,965 tons; railroad ties, 7,926; fish, dry, 340 pounds; roofing gravel, 512 tons; hoop poles, 5,000; sand, 5,904 tons; laths, 1,774,000 bundles; shingles, 2,628,000; lime, 23,785 barrels; stone, 4,823 tons; lumber, 3,233,491 feet; turnips, 100 bushels; oil, 925 barrels; wax, 325 barrels; paper, 146 rolls; wood, 752 cords.

Vessels drawing from 6 to 22 feet frequent the port.

B 10.

IMPROVEMENT OF HARBOR AT LYNN, MASS.

Lynn Harbor is situated 9 miles northeast from Boston. It is 1 by 2 miles, approximately, in extent, the greater part of which is dry at low tide.

It is protected on the north and west by the mainland, and on the east by Nahant Beach, and its entrance, 2 miles wide, into Massachusetts Bay, is on the south side.

A plan of the harbor, showing the projected improvement, was published in the Annual Report of the Chief of Engineers for 1884, Part I, p. 532.

Before improvement three narrow and crooked channels of approach to the wharves existed, in each of which there was about 6 feet depth at mean low water. The mean rise or fall of the tide is 9.3 feet.

The western channel leads to the Point of Pines and the mouth of Saugus River.

The main ship channel is entered between White and Lobster rocks, and connects about 3,600 feet northward with the Black Rock Channel, which is the most eastern, near Nahant Beach.

The project for improvement was adopted in 1884. It provides for the excavation of a channel 200 feet wide and 10 feet deep at mean low water, from a point near and east of the White Rocks, to deep water opposite Little Nahant, a distance of 3,610 feet. This is called the outer improved channel, and is merely a rectification and deepening of the main ship channel. The combined main ship channel and Black Rock Channel are sufficient for the purpose of commerce for the next 2,500 feet. Then commences the inner improved channel, which is projected 6,450 feet long, 200 feet wide, and 10 feet deep at mean low water. It extends from deep water, opposite Sand Point, to the harbor commissioners line, and follows very closely in direction the extension of the united main ship and Black Rock channels.

On September 24, 1888, this project was modified. It was then proposed to extend the main ship channel 400 feet within the harbor line

nd to excavate at its inner end a basin 500 by 300 feet in area, 10 feet eep at mean low water.

It is supposed that the inner channel will need to be dredged occaonally to maintain its width and depth, but a training wall about 6,000 et long has been proposed to aid in keeping the outer channel open, experience shall show it to be necessary. This wall is to start from ıe shore at "Little Nahant," and is to cross Black Rock Channel. s outer portion is to be parallel to the outer improved channel.

The cost of the original project was estimated to be $145,000. This stimate was revised in 1885, and then made $157,000, to provide for n increased amount of dredging, found to be necessary during the rogress of the work, to round off the junctions of the natural channel ith the dredged channel; to provide flatter slopes to the sides of the its than was originally designed, and also to provide funds for necesary surveys during the progress of the work.

The modifications proposed September 24, 1888, were estimated to ost $25,000, which would make the total cost of the improvement 182,000.

The total appropriations for this work have been $101,000.

The amount expended to June 30, 1892, was $85,098.13.

On June 30, 1892, the outer channel and the basin were completed as roposed. The inner channel was 150 feet wide.

The act of July 13, 1892, appropriating $10,000 for this harbor, proided "that the whole or any portion of this appropriation may be xpended on the western channel in the discretion of the Secretary of Var."

On October 19, 1892, it was recommended, and on October 24, 1892, pproved, that of the available funds $10,000 should be expended in redging a channel 150 feet wide and 8 feet deep at mean low water at ıe entrance of the western channel, or the one leading to the mouth of ıe Saugus River, and that the balance of the funds be expended in idening the inner channel of the main harbor to its full projected di-ıensions, so far as they would suffice.

On November 21, 1892, an advertisement was issued calling for proosals for the proposed dredging. The bids received were opened De-ember 21, 1892, and an abstract of them will be found in the annexed able.

On January 5, 1893, a contract was entered into with Messrs. Boynton ros., of Boston, Mass., to dredge 40,000 cubic yards.

Operations under this contract were commenced in June, 1893, and s but 4,583 cubic yards were dredged during the year the condition of ıe improvement is essentially the same as on June 30, 1892.

To complete this improvement will require an appropriation of 81,000, of which $20,000 could be expended to advantage during the scal year ending June 30, 1895, in completing the proposed dredging.

Lynn is a port of entry in the collection district of Marblehead, Mass. The near-st light-house is Egg Rock (Nahant) Light, 3 miles distant.

The accompanying commercial statistics for the fiscal year ending une 30, 1893, have been furnished by the collector of customs at Mar-lehead, Mass.

The date and amount of appropriations for this work are as follows:

t of—	
August 2, 1882	$60,000
August 5, 1886	6,000
August 11, 1888	10,000
September 19, 1890	15,000
July 13, 1892	10,000
Total	101,000

Money statement.

1892, balance unexpended		10,000.00
t appropriated by act approved July 13, 1892		15,901.87
		654.28
30, 1893, amount expended during fiscal year		15,247.59
1, 1893, balance unexpended	$1,552.49	
1, 1893, outstanding liabilities	11,997.51	
		13,550.00
y 1, 1893, amount covered by uncompleted contracts		1,697.50
ly 1, 1893, balance available		81,000.00
Amount (estimated) required for completion of existing project		20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging from Lynn Harbor, Massachusetts, opened December 21, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for— Dredging per cubic yard.	Removal of bowlders over 3 tons.	Total yards can be removed at price bid.	Remarks.
		Cents.			
1	Boynton Bros., Boston, Mass	33½	$10	41,332	Lowest bid.
2	Charles H. Souther, Boston, Mass	36½	10	38,354	
3	Augustus B. Martin, Boston, Mass	38	8	36,843	
4	Augustus R. Wright, Portland, Me	36½		38,354	

The contract was awarded to Messrs. Boynton Bros., with the approval of the [illegible] Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected 1891, $4,855.96; 1892, $3,545.17; 1893, $4,755.48.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	18	1,878	33	2,760	42	4,6[illegible]
Domestic	453	95,130	734	150,000	1,207	245,27[illegible]
Clearances:						
Foreign	21	2,702	31	3,790	48	5,2[illegible]
Domestic	447	93,870	736	146,000	1,207	245,2[illegible]

Imported.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
Coal	147,000	148,577	139,[illegible]
Iron	750	1,447	*5,911,
Lumber	12,380	*10,326,000	†2,540.
Merchandise		25,000	21,[illegible]
Miscellaneous	22,786		

* Feet. † Shingles, laths, etc.

[illegible]quent the harbor, drawing from 12 to 16 feet of water.

B 11.

IMPROVEMENT OF HARBOR AT WINTHROP, MASS.

This harbor is situated in the northeastern part of Boston Harbor, immediately westward of Winthrop Head.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part 1, page 470.

The harbor contains, approximately, 350 acres, all of which is dry at low tide except a short, narrow, crooked slough east of Snake Island. The mean range of tides is 9.4 feet.

The nearest deep-water channel of Boston Harbor is known as the "Back" Channel, and it extends from Point Shirley to East Boston. It has from 9 to 16 feet depth at low tide. The town wharf is distant 3,900 feet from this "Back" Channel.

The original project for the improvement of this harbor was submitted November 28, 1887; it was based on the survey provided for in the river and harbor act of August 5, 1886.

The project proposes to excavate a straight channel 3,900 feet long, 0 feet wide, and 6 feet deep at mean low water, from the "Back" Channel to Rice's Wharf, at an estimated cost of $17,600.

For this improvement the following appropriations have been made:

act of—	
August 11, 1888	$1,000
September 19, 1890	5,000
July 13, 1893	3,000
Total	9,000

The amount expended to June 30, 1892 was $5,497.80.

On June 30, 1892, the improved channel was 3 feet deep at mean low water, 3,900 feet long, and 35 feet wide; opposite Rice's Wharf it was feet wide.

On November 15, 1892, an advertisement was issued calling for proposals to complete the improvement.

The bids received were opened December 15, 1892, and an abstract them will be found in the annexed table.

On December 20, 1892, a contract was entered into with Mr. O. E. Lewis, of Winthrop, Mass., to complete the improvement.

Operations under this contract were commenced in March, 1893, and were satisfactorily completed in May, 1893.

Winthrop Harbor, Massachusetts, is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is at Deer Island Point, Boston Harbor, Massachusetts. Commercial statistics are included in the statement for Boston Harbor.

Money statement.

July 1, 1892, balance unexpended		$502.20
Amount appropriated by act approved July 13, 1892		3,000.00
		3,502.20
June 30, 1893, amount expended during fiscal year		3,477.05
July 1, 1893, balance unexpended		25.15

Abstract of proposals for dredging from Winthrop Harbor, Massachusetts, opened December 15, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidder.	Price bid for the whole work.	Remark.
1	O. E. Lewis, Winthrop, Mass	$3,000	Only bid.

The contract was awarded to Mr. O. E. Lewis, with the approval of the Chief of Engineers.

B 12.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS, MASSACHUSETTS.

These two rivers empty into the inner harbor of Boston, Mass.

The main river (Mystic) extends from the navy-yard to the town of Medford, a distance of about 4½ miles. Malden River is about 2 miles long, from the town of Malden to its junction with Mystic River, about 3 miles above the navy-yard.

Originally Mystic River had no navigable low-water channel. A project for its improvement was submitted May 9, 1891. It proposed to widen and deepen the natural channel of the river so that it should be 100 feet wide and 6 feet deep at mean low water to the first turn above Denning's Wharf, and thence to the head of navigation 4 feet deep, with the width gradually reduced to 50 feet at Craddock's Bridge. The cost of this improvement was estimated to be $25,000.

Originally in Malden River there was in a narrow and exceedingly crooked channel a navigable depth of barely 7 feet at mean high water. The rise of the tide is 9.8 feet. The original project for its improvement was proposed December 1, 1880. It contemplated the excavation of a channel 100 feet wide and 12 feet deep at mean high water up to the second drawbridge, with two cut-offs, one east of the island near the junction of the Malden and Mystic rivers, and the other through the marsh land, about half a mile above, at a cost of $35,000.

This project was modified in 1882. It was then proposed to make the natural channel 100 feet wide and 12 feet deep at mean high water to the first bridge, and thence 75 feet wide to the second bridge, at an estimated cost of $40,000.

Ten thousand dollars were appropriated for this work by the act of August 2, 1882, and expended (1883–'84) in making the channel from the mouth to the drawbridge in Malden, a distance of 1¼ miles, at least 50 feet wide (70 feet at turns), 12 feet deep at mean high water.

By the act of July 13, 1892, $10,000 were appropriated for the improvement of Mystic and Malden rivers.

On July 18, 1892, it was recommended that one-half of this amount be retained in the Treasury for the improvement of Malden River (when additional funds are available), and that the balance be expended in improving Mystic River as proposed from its mouth to Denning's Wharf.

On August 8, 1892, an advertisement was issued calling for proposals for this work. The bids received were opened September 8, 1892, and an abstract of them will be found in the annexed table.

The lowest bid was deemed excessive and it was rejected.

No other operations were in progress during the fiscal year, and at the date of this report the original condition of Mystic River is unaltered; and the improved channel of Malden River is at least 50 feet wide (70 feet at turns), 12 feet deep at mean high water, to the first bridge in Malden, a distance of 1¼ miles.

To complete the improvement of Mystic River would require an appropriation of $20,000, and for Malden River $30,000, a total of $50,000, all of which could be expended to advantage during the fiscal year ending June 30, 1895.

Mystic and Malden rivers are in the collection district of Boston, Mass., of which Boston is the port of entry; the nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Commercial statistics are included in the statement for Boston Harbor.

The dates and amounts of appropriations for this work are as follows:

For Malden River, by act of August 2, 1882	$10,000
For Mystic and Malden rivers by act of July 13, 1892	10,000

Money statement.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	41.55
July 1, 1893, balance unexpended	9,958.45
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging from Mystic River, Massachusetts, opened September 8, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards can be dredged at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	Augustus B. Martin, Boston, Mass	50	$10	9,000	
2	Charles H. Souther, Boston, Mass	55	10	8,181	
3	Augustus R. Wright, Portland, Me	48	3	9,375	Lowest bid.

The lowest bid was rejected, with the approval of the Chief of Engineers.

B 13.

IMPROVEMENT OF HARBOR AT BOSTON, MASS.

Boston Harbor consists essentially of an inner and outer harbor, united by a deep water way, and each accessible from the sea by a distinct channel, widening into a deep and spacious roadstead.

1. Inner harbor.—This harbor lies to the north and westward of Long Island, and has deep water and good anchorage in the President Roads,

seaward of Lower Middle Bar, and also near the city, westward of Upper Middle Bar.

Four rivers discharge their waters into this basin, the Charles, Mystic, and Chelsea rivers from the north, and the Neponset from the south. The direct entrance from the sea is by Broad Sound.

2. Outer harbor.—This harbor lies to the southward of Long Island, and has a fine anchorage in Nantasket Roads, as well as in Hingham Bay, a well-sheltered harbor southeast of Peddocks Island. It connects with the inner harbor by the main ship channel through the "Narrows," and by secondary channels east and west of Long Island. It is reached from the sea by Nantasket Roads, which lie south of Georges and Great Brewster islands, and is marked at the sea entrance by Boston Light.

Weymouth and Weir rivers empty into the outer harbor.

Both the inner and outer harbors are subdivided into several minor harbors and contain many islands, which shelter the anchorages from winds and storm waves.

The range of tides at the navy-yard is 9.8 feet and at the entrance to the outer harbor 9.4 feet. A sketch of the harbor was printed in the Annual Report of the Chief of Engineers for the year 1888, page 454.

The object of the improvement is, first, to *preserve* the harbor by protecting the islands and headlands, and, second, to improve it by widening, deepening, and straightening the channels.

The works of preservation consist of sea walls, aprons, jetties, etc., which protect the shores of the islands and headlands, prevent additional wash into the channels, control the tidal scour, and preserve the full height of anchorage shelter for vessels in the roadstead.

The works of improvement have been by dredging and blasting.

The total appropriations from 1825 to date have been $2,604,276.10.

The total expenditures to June 30, 1892 (excluding outstanding liabilities), were $2,216,351.59.

WORKS OF PRESERVATION.

Point Allerton.—This headland at the southeasterly entrance of the harbor is protected by a granite sea wall 1,202 feet in length, completed in 1873. Its concrete foundation for a distance of 1,005 feet is protected by an apron and eight short jetties of granite rubblestone. No work was done on it during the fiscal year.

Its condition, June 30, 1893, is as follows:

The wall is generally in good order, although some of its joints need repointing. The bluff protected by this wall is not fully covered from storm action, and the sea wall should be extended westward for a distance of at least 150 feet, and the foundation of this extension should be protected with riprap.

This is estimated to cost $15,000.

Great Brewster Island.—This island is on the north side of the main ship channel near the entrance. It is protected by a granite sea wall 2,840 feet long, which was completed in 1869. During the fiscal year about 400 running feet of the wall was repointed.

On June 30, 1893, the wall is in fair order, but some repointing is still needed, for which funds are available, and the work will be done during the next fiscal year.

Georges Island.—Its northern and eastern shores are protected by a granite sea wall 2,150 feet long. West of this wall a riprap protection extends for 450 feet, and south of it another 600 feet long. The sea

wall and southern riprap were built about 1835. The western riprap was built in 1884–'85.

No work was done on the wall or ripraps during the year, and they are in good order at the date of this report.

The unprotected western shore line of the island, in front of the Government buildings, has been considerably abraded, and it should be protected by a light sea wall, 1,400 feet long, at a cost of $35,000.

Lovells Island.—The western shore of this island is protected by a rubblestone apron, 975 feet long, built in 1873 and repaired and extended in 1884; the northern shore is covered by a granite sea wall 750 feet long, built in 1843, and the eastern shore is protected by a granite sea wall 800 feet long, built in 1869 and repaired in 1879 and 1886, and by two rubblestone aprons, one between the northern and eastern sea walls, 1,440 feet long, and the other south of the east sea-wall, 1,330 feet long.

No operations were in progress during the fiscal year.

The condition of the works on June 30, 1893, was as follows: The sea walls and the ripraps on the eastern shore were in good order; the western shore riprap was undermined in places and had fallen down, but it needed no immediate repairs.

Gallops Island.—The western, northern, and eastern shores of this island are protected by a granite sea wall 2,385 feet long, completed in 1892, and by a rubblestone apron, completed in 1884, 3,050 feet long, which also covers part of the foundation of the sea wall. No operations were in progress during the fiscal year, and at the date of this report the works are in good order.

Deer Island.—Three prominent bluffs of this island are protected by granite sea walls, originally built about 1827. The north head wall is 1,740 feet long, the middle head wall is 840 feet, and the south head wall is 380 feet long. In 1865 and 1869 these walls were partly rebuilt, and in the weakest places were backed with concrete. They were all originally built dry, and from time to time have required repairs.

No operations on these sea walls were in progress during the year, and they are in good order at the date of this report.

Long Island.—The north head of this island is protected by a granite sea wall 2,081¾ feet long, completed in 1874. Part of the foundation of the sea wall and of the beach at both its ends is protected by a rubblestone apron, aggregating 1,675 feet in length. This apron was built in 1874, and extended in 1884 and 1892.

During the fiscal year the riprap west of the sea wall was completed, and at the date of this report the wall, ripraps, and beaches are in good order.

Rainsford Island.—The north head of this island is protected by a dry granite sea wall 1,500 feet long, originally built about 1840, and extensively repaired in 1884–'85. No work was done during the fiscal year, and on June 30, 1893, the wall was in good order.

Castle Island.—The north and part of the east and west shores of this island are protected by a dry granite sea wall 3,300 feet long, built about 1835. A light riprap extends along the east shore 300 feet from the end of the wall; this was built in 1865. No work was done during the year ending June 30, 1893, and at that date the riprap was in good order. The sea wall needed repairs on the north face, a short distance west of the wharf, where the foundation has been undermined and the wall has settled. About 100 running feet of the wall has been thus injured, and this length of the wall needs taking down and rebuilding, at a cost of $1,000.

Governors Island.—The shore line of this island has never been protected. The east and south bluffs, however, should be covered by sea

walls to prevent additional abrasion, not only to secure the sites of the batteries which occupy these bluffs, but also to prevent injury to the main ship channel.

The east bluff wall should be 500 feet long, and is estimated to cost $30,000; the south bluff wall should be 1,800 feet long, and will cost $50,000.

WORKS OF IMPROVEMENT.

The main ship channel.—Before improvement it had a least width of 100 feet and a least depth of 18 feet at mean low water. The original project for its improvement was submitted in 1867. It proposed to dredge the channel 23 feet deep at mean low water, 1,000 feet wide at the upper and lower middles, and 685 feet at the Narrows.

In 1870 the proposed width at the Narrows was reduced to 625 feet, and increased to 1,100 feet at the anchorage shoal in the inner harbor.

In 1887 it was proposed to straighten the passage through the Narrows by cutting off a spur that projected from Lovells Island, which was estimated to contain 20,000 cubic yards.

A revised project for its improvement was submitted August 11, 1892. It proposed, in accordance with the act of July 13, 1892, to widen and deepen the channel so that it should be 1,000 feet wide and 27 feet deep at mean low water. This revised project was estimated to cost $1,250,000.

On June 30, 1892, the main ship channel was 23 feet deep at mean low water, 1,100 feet wide west of the Upper Middle, 800 feet wide at the Upper Middle, 1,000 feet wide at the Lower Middle, and at least 625 feet wide elsewhere.

In effecting this improvement dredging or blasting was done at the following places:

At Nashs Rock Shoal, during the years 1876–'78, 365 cubic yards of ledge were removed.

At Kellys Rock and Shoal, during the years 1869–'79, 222 cubic yards of ledge were removed.

Tower, Corwin, and Channel Rocks were removed during the years 1867–'75; they aggregated 608¾ cubic yards.

From the west end of Brewster Spit, during the years 1874–'76, 1891, and 1892, 57,736 cubic yards of sand and gravel were dredged, and 95½ cubic yards of ledge were removed.

At Lovells Island, from the southeast and southwest points, 267,294½ cubic yards were dredged during the years 1867–'77, and from a spar between these points 3,430 cubic yards were dredged in 1888.

At Castle Island Bar and Shoal, opposite the Lower Middle, during the years 1880–'83, 36,957 cubic yards were dredged, and 20 tons of rock were removed.

At the Lower Middle, in 1874–'75, State and Palmyra rocks were removed; they aggregated 62 cubic yards. In 1887–'89 71,892 cubic yards were dredged from this shoal, and 375 cubic yards of ledge were removed.

At the Upper Middle, during the years 1870–'76, 1880–'92, 489,239 cubic yards were dredged, and 229 cubic yards of ledge were removed.

At Anchorage Shoal, during the years 1879–'82, 65,327 cubic yards were dredged.

At Man-of-War Shoal, 85,917 cubic yards were dredged in the year 1878–'80.

At Mystic River Shoal, during the years 1879–'82, 82,082 cubic yards were dredged.

During the fiscal year 137,213 cubic yards were removed from the Upper Middle Shoal under the contract of December 19, 1891; this contract was satisfactorily completed November 7, 1892, and the main ship channel, at this shoal, was thus made 850 feet wide.

On August 11, 1892, a project was submitted for the expenditure of the funds available for the main ship channel, viz, $265,000. It proposed that work under the revised project of August 11, 1892, be commenced. This was approved August 15, 1892.

On August 20, 1892, an advertisement was issued inviting proposals for this work. The bids received were opened September 20, 1892, and an abstract of them will be found in the annexed table.

On October 17, 1892, a contract was entered into with Mr. Charles H. Souther, of Boston, Mass., and Mr. Augustus R. Wright, of Portland, Me., to dredge 500,000 cubic yards from the main ship channel, or sufficient to make the channel 1,000 feet wide, 27 feet deep at mean low water from the entrance of the harbor to the "narrows," and to widen the channel in part of the "narrows" so that 27 feet depth at mean low water could be carried in a channel at least 800 feet wide to the anchorage west of Georges Island.

Operations under this contract were commenced in December, 1892, and suspended in February, 1893; recommenced in June, 1893, and as but 5,666 cubic yards have been removed under the contract, the condition of the main ship channel at the date of this report is as follows: 23 feet deep at mean low water, 1,100 feet wide west of the Upper Middle, 850 feet wide at the Upper Middle, 1,000 feet wide at the Lower Middle, and at least 625 feet wide elsewhere.

The following tributary channels have been improved by dredging or blasting.

1. CHARLES RIVER.

This river empties into the inner harbor near the navy-yard at Charlestown.

Before improvement the natural channel had, as far up as Western Avenue Bridge, 4¾ miles from its mouth, 7 feet depth at mean low water, except in several places, covering about 1¼ miles in length below Brookline Street Bridge, where the depth varied from 4½ to 7 feet.

From Western Avenue Bridge to Arsenal Street Bridge (2½ miles) there was a depth of 4 feet at mean low water; thence to Market Street Bridge (¾ mile) 2½ feet at mean low water; and thence, to the dam at the head of tide water (1¾ miles), a depth varying from 0 to 9½ feet above mean low water. The mean rise or fall of the tide is 10 feet. A sketch showing the river was published in the Annual Report of the Chief of Engineers for 1884, p. 512.

The project for the improvement of this river consists in straightening, widening, and deepening the natural channel, so that it should be from its mouth to Western Avenue Bridge, 7 feet deep at mean low water and 200 feet wide; from Western Avenue Bridge to Market Street Bridge, 6 feet deep at mean low water and 80 feet wide; thence, to the dam at the head of tide water, 60 feet wide and 2 feet deep at mean low water.

The estimated cost of this improvement was originally $85,000. A revised estimate was submitted in 1881 of $125,000.

The total allotments from the appropriations for Boston Harbor for this improvement to date have been $77,500.

The expenditures to June 30, 1892, were $57,500. No operations were in progress during the fiscal year, and the condition of the improvement June 30, 1893, was as follows: The projected channel had been completed from the mouth of the river to Arsenal Street Bridge (7¼ miles); work was stopped at this point for the reason that the piers and draws of this bridge do not conform to the projected channel above it. In effecting this improvement 127,971 cubic yards were dredged during the years 1880–'84.

2. FORT POINT CHANNEL.

This channel is situated between the eastern shore of Boston proper on the one side and the reclaimed and improved flats of South Boston on the other side. It connects the tidal basin of South Bay, which has an area of 250 acres, with Boston Inner Harbor; is fast becoming the center of the city's most extensive shipping trade, and is the most important branch of the main ship channel. Fort Point Channel is 1¼ miles long.

Before improvement the least depth at mean low water was 12 feet at its entrance, and 17 feet above Congress Street Bridge.

That part of it which it is proposed to improve is spanned by bridges at Congress street, Mount Washington avenue, and at an intermediate point. These bridges have conveniently located draw openings, but the draw piers of the railroad bridge must be strengthened or reconstructed before the improvement can be extended past them, and the width of the draw increased to that of the other bridges above and below it.

The project for this improvement was submitted January 27, 1885. It proposed the excavation of a channel 175 feet wide and 23 feet deep at mean low water, from the entrance to near Federal Street Bridge, a distance of 4,100 feet, and was estimated to cost $100,000, the railroad bridge to be reconstructed at the expense of the owners.

By the act of August 5, 1886, $18,750 was allotted for the improvement of this channel from the appropriation for Boston Harbor.

The total expenditures to June 30, 1892, were $18,750.

No operations were in progress during the year and the condition of the improvement June 30, 1893, was as follows: The channel had been dredged as proposed from its entrance to Congress Street Bridge, a distance of 1,900 feet; 94,211 cubic yards were removed in effecting this improvement during the year 1887.

To complete the improvement as proposed to Federal Street Bridge will cost $60,000, and this sum could be expended to advantage during the fiscal year ending June 30, 1895, if the railroad draw shall have been properly reconstructed.

3. HINGHAM HARBOR.

See separate report.

4. NANTASKET BEACH CHANNEL.

This is a small channel along the east side of Hingham or Hull Basin. It leads to a wharf on the west side of the heel of Nantasket Beach, about 12 miles from Boston.

Before improvement it was approximately 100 feet wide and had a

depth of at least 11 feet, except at the eastern end, 1,500 feet from the wharf, where the width was reduced to from 40 to 50 feet and the depth to less than 8 feet. It was circuitous and obstructed by bowlders at the mouth of Weir River and by a ledge near the wharf.

The project of improvement adopted in 1880 and completed in 1881–'83, was to widen and deepen the channel from the mouth of Weir River to the steamboat wharf, so that it would be 100 feet wide and 9½ feet deep at mean low water, to remove a few bowlders at the mouth of Weir River, and to remove the ledge near the wharf.

In 1891, in accordance with the act of September 19, 1890, the channel was widened to 150 feet.

The total allotments for this work from the appropriations for Boston Harbor to date have been $31,067.80, of which $19,523.83 had been expended to June 30, 1892.

On June 30, 1892, the channel was at least 150 feet wide, 9½ feet deep at mean low water, except over a ledge uncovered by the dredging near the wharf.

On July 18, 1892, it was recommended that the funds available for this work be expended in deepening the channel to 12 feet at mean low water. This recommendation was approved July 25, 1892. On August 8, 1892, an advertisement was issued inviting proposals for this work, and the bids received were opened September 8, 1892. An abstract of them will be found in the annexed table.

On September 22, 1892, a contract was entered into with Augustus B. Martin, of Boston, Mass., to dredge 20,000 cubic yards.

Operations under this contract were commenced in June, 1893, and at the date of this report 21,594 cubic yards had been dredged.

Tonnage of the channel in—

	Tons.
1874	390,226
1889	654,920
1890	703,340
1891	800,000
1892	820,000

5. CHANNEL BETWEEN NIXS MATE AND LONG ISLAND.

This is a channel through the bar which extends from the north head of Long Island to Nixs Mate Shoal. Previous to improvement there was 4½ feet depth of water on the bar at mean low tide.

The project for the improvement was adopted in 1883. It was to dredge a channel 200 feet wide, 12 feet deep at mean low water, and about 550 long. In 1887 it was recommended that the axis of the cut be shifted 30 degrees to the westward, and that it be widened to 300 feet, 15 feet deep at mean low water. The original project was estimated to cost $9,000. The project of 1887 was estimated to cost $25,000 additional. No specific appropriation has been made for this work. The expenditures on it to June 30, 1892, from the appropriations for Boston Harbor, were $24,982.97. No operations were in progress during the fiscal year, and at the date of this report the channel is 300 feet wide, 15 feet deep at mean low water.

6. BROAD SOUND.

An obstruction called Barrel Rock, lying on the north side of the Broad South Channel, was removed in 1869. It contained 116 cubic yards.

7. JEFFREYS POINT CHANNEL.

This channel is an extension of the main ship channel from near Grand Junction Wharf (East Boston) toward Jeffreys Point.

A project for its improvement was submitted December 2, 1890, in accordance with the act of September 19, 1890. It proposed to dredge a channel 400 feet wide from Grand Junction Wharf to just east of Simpson's Patent Dry Docks, and 18 feet deep at mean low water. Thence gradually narrowing the proposed channel to 250 feet, and decreasing the depth of water to 15 feet at mean low water to a junction with the same depth off Jeffreys Point. This was estimated to cost $50,000.

The total allotments for this work to date from the appropriations for Boston Harbor have been $50,000.

The expenditures to June 30, 1892, were $25,000.

On June 30, 1892, the improved channel was 275 feet wide, 18 feet deep at mean low water from Grand Junction Wharf to just east of Simpson's Patent Dry Docks, and thence gradually narrowed to 250 feet and shoaled to 15 feet to a junction with the same depth off Jeffreys Point.

On July 18, 1892, a project was submitted for the expenditure of the funds available for this work. This project was that the improvement be completed, and it was approved August 15, 1892.

An advertisement inviting proposals for this work was issued under date of August 20, 1892. The bids received were opened September 20, 1892, and an abstract of them will be found in the annexed table.

On September 30, 1892, a contract was entered into with Mr. Charles H. Souther, of Boston, Mass., to dredge 55,000 cubic yards from this channel.

Operations under this contract were commenced in October, 1892, and were suspended in November, 1892. A total of 20,697 cubic yards were dredged under this contract during the fiscal year, and at the date of this report the channel is 350 feet wide from Grand Junction Wharf to just east of the dry docks, 18 feet deep at mean low water, and thence to Jeffreys Point the channel is completed as proposed.

The expenditures for this channel during the year have been $7,863.09.

Recapitulation of amounts which could be expended to advantage during the fiscal year ending June 30, 1895.

Extension of Port Allerton sea wall	$15,000
Sea wall for Georges Island	35,000
Sea walls for Governors Island	80,000
Widening main ship channel at Upper Middle	160,000
Completion of Fort Point Channel	60,000
Continuation of revised project for main ship channel	350,000
Total	700,000

The several works completed and projected for the improvement of this harbor are located in the collection district of Boston and Charlestown, Mass. Boston is the port of entry.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Boston, Mass.

tes and amounts of appropriations for this work are as follows:

		Act of—	
2, 1825	$52, 972. 56	July 12, 1866	$75, 000. 00
19, 1828	2, 000. 00	March 2, 1867	375, 000. 00
3, 1828	87, 000. 00	July 11, 1870	100, 000. 00
2, 1829	7, 310. 54	March 3, 1871	100, 000. 00
2, 1831	5, 000. 00	June 10, 1872	75, 000. 00
ary 24, 1832	9, 000. 00	March 3, 1873	150, 000. 00
2, 1831	12, 390. 00	June 23, 1874	100, 000. 00
, 1832	60, 000. 00	March 3, 1875	100, 000. 00
3, 1841	1, 500. 00	August 14, 1876	50, 000. 00
t 31, 1842	2, 000. 00	June 18, 1878	55, 000. 00
1836	15, 000. 00	March 3, 1879	50, 000. 00
1838	7, 353. 00	June 14, 1880	75, 000. 00
3, 1841	1, 000. 00	March 3, 1881	100, 000. 00
3, 1843	16, 000. 00	August 2, 1882	96, 500. 00
1864	10, 000. 00	July 5, 1884	5, 000. 00
ary 28, 1865	3, 000. 00	August 5, 1886	56, 250. 00
2, 1866	50, 000. 00	August 11, 1888	125, 000. 00
0, 1848	40, 000. 00	September 19, 1890	145, 000. 00
t 30, 1852	30, 000. 00	July 13, 1892	300, 000. 00
1864	40, 000. 00		
ary 28, 1865	20, 000. 00	Total	2, 604, 276. 10

Money statement.

2, balance unexpended		$87, 924. 51
propriated by act approved July 13, 1892		300, 000. 00
		387, 924. 51
93, amount expended during fiscal year		48, 512. 21
3, balance unexpended		339, 412. 30
3, outstanding liabilities	$9, 009. 30	
3, amount covered by uncompleted contracts	248, 540. 08	
		257, 549, 38
3, balance available		81, 862. 92
(estimated) required for completion of existing project		1, 300, 000. 00
that can be profitably expended in fiscal year ending June 5		700, 000. 00

ed in compliance with requirements of sections 2 of river arbor acts of 1866 and 1867 and of sundry civil act of March

f proposals for dredging from Nantasket Beach Channel, Boston Harbor, ssetts, opened September 8, 1892, by Lieut. Col. S. M. Mansfield, Corps of En-

Bidders.	Price bid for—		Total yards can be dredged at price.	Remarks.
	Dredging, per cubic yard.	Removal of bowlders over 3 tons weight.		
	Cent.			
us B. Martin, Boston, Mass	37	$10	24, 324	Lowest bid.
H. Souther, Boston, Mass	45	15	20, 000	
us R. Wright, Portland, Me	40	3	22, 500	

ract was awarded to Mr. Augustus B. Martin, with the approval of the ngineers.

Abstract of proposals for dredging from the channel leading to Jeffrey's Point, Boston Harbor, Massachusetts, opened September 20, 1892, by Capt. S. S. Leach, Corps of Engineers, during the official absence of Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total.	Remarks.
		Dredging, per cubic yard.	Removal of bowlders over 6 tons weight.		
		Cents.			
1	Augustus R. Wright, Portland, Me	36	$3	$19,800	
2	Charles H. Souther, Boston, Mass	34½	10	18,975	Lowest bid.
3	Augustus B. Martin, Boston, Mass	37	10	20,350	

The contract was awarded to Mr. Charles H. Souther, with the approval of the Chief of Engineers.

Abstract of proposals for dredging from the main ship channel, Boston Harbor, Massachusetts, opened September 20, 1892, by Capt. S. S. Leach, Corps of Engineers, during the official absence of Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards can be removed at price bid.	Remarks.
		Dredging, per cubic yard.	Removal of bowlders over 6 tons weight.		
		Cents.			
1	Charles H. Souther, Boston, Mass., and Augustus R. Wright, Portland, Me.	49½	$20	500,000	Only bid.

The contract was awarded to Mr. Charles H. Souther and Mr. Augustus R. Wright, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, $18,038,772.34; 1892, $14,491,854.98; 1893, $15,791,588.16.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	2,474	1,502,750	2,262	1,663,711	2,373	1,633,740
Clearances:						
Foreign	2,376	1,226,378	2,181	1,406,650	2,231	1,330,165

	1891.	1892.	1893.
Importations:			
Merchandise	$71,212,614	$71,780,489	$79,357,654
Coin and bullion	10,238	12,944	29,297
Exportations:			
Foreign merchandise	300,564	564,140	865,265
Domestic merchandise	76,731,823	86,610,067	84,506,157
Coin and bullion	1,250,000		2,250,250

B 14.

IMPROVEMENT OF WEYMOUTH RIVER, MASSACHUSETTS.

Weymouth (Fore) River, tributary to Hingham Bay, Boston Harbor, Massachusetts, on the southwest, is one of the most important water courses on the south coast of Massachusetts Bay. It is navigable at low water for vessels not exceeding 18 feet draft for 4 miles from its mouth, and for a further distance of 3 miles, to the head of navigation, at least 3 feet depth was found at mean low water before its improvement.

The original project for its improvement was submitted December 2, 1889. It was based on the survey provided for in the act of August 11, 1888, and proposed to improve the natural channel of the river by dredging, so that 6 feet depth at mean low water could be carried to the head of navigation, in a channel 100 feet wide to near the wharves at Weymouth Landing; thence to Braintree Bridge 80 feet wide, and above the bridge 50 feet wide, with increased width at each turn to facilitate the movement of vessels. The total length of channel to be improved was 7,000 feet, approximately, and the cost was estimated to be $40,000.

The total appropriations for this work to date have been $20,000.

The expenditures to June 30, 1892, were $10,000.

On June 30, 1892, the improved channel was 6 feet deep at mean low water, 40 feet wide to Braintree Bridge, and 25 feet wide thence to the head of navigation.

On July 18, 1892, it was recommended that the available funds be expended in widening the improved channel to 60 feet below Braintree Bridge and in completing it above the bridge. This was approved July 23, 1892.

On August 8, 1892, an advertisement was issued inviting proposals for this work.

The bids received were opened September 8, 1892, and an abstract of them will be found in the annexed table.

The lowest bid received was regarded as excessive and it was rejected.

No other operations were in progress during the fiscal year, and at the date of this report the improvement is in the same condition as on June 30, 1892.

The dates and amounts of the appropriations for this work are as follows:

By act of—	
September 19, 1890	$10,000
July 13, 1892	10,000
Total	20,000

The amount required to complete the improvement is $20,000, all of which could be expended to advantage during the fiscal year ending June 30, 1895.

Weymouth River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

Money statement.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	38.64
July 1, 1893, balance unexpended	9,961.36
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Weymouth River, Massachusetts, opened September 8, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards can be dredged at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders weighing over 6 tons.		
		Cents.			
1	Augustus B. Martin, Boston, Mass	58	$10	15,517	
2	Charles H. Souther, Boston, Mass	60	18	15,000	
3	Augustus R. Wright, Portland, Me	54	10	16,666	Lowest bid.

The lowest bid was rejected, with the approval of the Chief of Engineers.

B 15.

IMPROVEMENT OF HARBOR AT HINGHAM, MASS.

Hingham Harbor is situated in the southern part of Hingham or Hull Basin, which comprises all that part of Boston lower harbor south of Nantasket Roads.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for 1888, Part I, p. 456.

The harbor covers an area of one square mile and has extensive mud flats, bare at low tide.

The mean rise or fall of the tide is 9.4 feet.

The channel leading to Hingham, south of Ragged and Sailor islands, was before improvement very narrow and crooked and obstructed by sunken rocks and shoals. Its least width was 30 feet and least depth 4 feet at mean low water.

The object of its improvement is to widen and deepen the natural channel from deep water, near the head of the harbor, to the steamboat wharf, a distance of 2,500 feet.

The original project for improvement was submitted December 23, 1874.

It provided for an improved channel on the east side of Sailor Island, past the west side of beacon to the Hingham wharf, 100 feet wide and 8 feet deep at mean low water, at an estimated cost of $11,000.

This project was modified January 20, 1885, when it was proposed to

deepen the improved channel to 10 feet at mean low water, and to remove a mid-channel ledge lying between Chandler and Ragged islands, measuring 128 cubic yards, at an estimated cost of $18,700.

The total amount appropriated for this work to date is $29,000.

The expenditures to June 30, 1892, were $25,088.35.

On June 30, 1892, the revised project for the improvement of the harbor had been completed, with the exception of the removal of the mid-channel ledge.

On July 18, 1892, it was proposed to expend the available funds in completing the project by the removal of the mid-channel ledge. This was approved July 22, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for this ledge work.

The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 14, 1892, a contract was entered into with Messrs. Geo. W. Townsend & Co., of Boston, Mass., to remove 128 cubic yards of ledge.

Operations under this contract were commenced in October, 1892; were suspended on account of ice in the harbor during part of March and April, 1893, and were satisfactorily completed in May, 1893.

No other operations were in progress during the fiscal year, and at the date of this report the project for the improvement of this harbor is completed.

Hingham Harbor is in the collection district of Boston, Mass. The nearest lighthouse is the Narrows Light, on the main ship channel in Boston Harbor, distant about 5 miles.

The dates and amounts of the appropriations for this work are as follows:

Allotted from appropriation for Boston Harbor, act of March 3, 1875	$10,000
Act of—	
March 5, 1886	6,000
August 11, 1888	5,000
September 19, 1890	5,000
July 13, 1892	3,000
Total	29,000

Money statement.

July 1, 1892, balance unexpended	$911.65
Amount appropriated by act approved July 13, 1892	3,000.00
	3,911.65
June 30, 1893, amount expended during fiscal year	3,897.41
July 1, 1893, balance unexpended	14.24

Abstract of proposals for removal of ledge from Hingham Harbor, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid per cubic yard in situ.	Total.	Remarks.
1	Hiram W. Phillips, Quincy Point, Mass	$26.80	$3,430.40	
2	Geo. W. Townsend and John Olsen, Boston, Mass	23.74	3,038.72	Lowest bid.

The contract was awarded to Messrs. Geo. W. Townsend & Co., with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Tonnage of the harbor in—	Tons.
1884	273,090
1889	569,070
1890	600,000

B 16.

IMPROVEMENT OF HARBOR AT SCITUATE, MASS.

Scituate Harbor is on the west shore of Massachusetts Bay, 14 miles from either Boston or Plymouth Light-houses, and just southwest of the direct sailing course of all ocean going-vessels entering Boston Harbor.

Before improvement the harbor had a low-water area of 57 acres, approximately, more than 6 acres of which had a depth of at least 5 feet at mean low water. It was entirely open to the action of east winds, and the entrance was obstructed by many sunken bowlders. The depth on the bar was about 2½ feet at mean low water. The mean rise or fall of the tide is 9.8 feet.

A plan of the harbor, showing the proposed improvement, was published in the Annual Report of the Chief of Engineers for 1881, Part I, p. 522.

The object of the improvement is to create a harbor of refuge for vessels bound to Boston that are too far south of their course to clear the dangerous ledges near Minots Light-house.

The project for the improvement adopted in 1881 is to build two rubblestone breakwaters converging from opposite shores, and to dredge an anchorage basin with channels connecting with the sea and the town wharves.

The north breakwater, from Cedar Point, is to be 800 feet long, and the south breakwater from the point of the first cliff is to be 730 feet. Both breakwaters are to be 20 feet wide on top and 4 feet above mean high water, except at their outer ends, which are to be built 6 feet higher, to serve as sites for entrance beacons; the anchorage basin to be 30 acres in area, approximately; the entrance channel to be 2,700 feet long and 300 feet average width.

The estimated amount of dredging (including the entrance channel) was 500,000 cubic yards, to give a depth of 15 feet in the entrance channel; 12 to 15 feet between the breakwaters, 12 feet immediately in rear of the south breakwater, and 10 feet for the anchorage basin; the channel leading to the town wharves is to be 3 feet deep, all at mean low water.

The estimated cost of the breakwaters was $100,000, and of the dredging $190,000, a total of $290,000.

The total amount appropriated for this work to date is $73,680.

The amount expended to June 30, 1892, was $63,530.

The condition of the improvement June 30, 1892, was as follows: The north breakwater was 720 feet long, of full width and height; the entrance channel was 100 feet wide, 1,600 feet long, and 5 feet deep at mean low water. Nothing had been done on the south breakwater.

A portion of the beach between Cedar Point and the mainland was protected by a brush and stone bulkhead 450 feet long, in front of which was a stone apron 10 feet wide, 385 feet long. All known bowlders obstructing the entrance of the harbor were removed.

The channel connecting the anchorage basin with the town wharves vas 3 feet deep at mean low water, and 100 feet wide, except at the ıpper end, where for a distance of 75 feet it averaged only 50 feet in vidth.

On July 18, 1892, it was recommended that the funds available for his work be expended in constructing about 300 feet of the south breakvater.

On August 5, 1892, an advertisement was issued inviting proposals or this work.

The bids received were opened September 7, 1892, and an abstract of hem will be found in the annexed table.

On September 17, 1892, a contract was entered into with Mr. Joseph I. White, of Boston, Mass., to deposit 3,643 tons of rubblestone in the outh breakwater.

Operations under this contract were commenced in September, 1892; vere suspended during January, February, March, and April, 1893; re-ommenced in May, 1893, and during the fiscal year 2,745½ tons of ubblestone were placed in the south breakwater, essentially completng 250 running feet of it.

No other operations were in progress during the fiscal year, and at he date of this report the north breakwater, the entrance channel, the nchorage bansin, and the channel leading to the town wharves are in he same condition as on June 30, 1892.

To complete the improvement will require an appropriation of $217,000, f which $40,000 could be expended to advantage during the fiscal year nding June 30, 1895, in completing the south breakwater.

Scituate is in the collection district of Plymouth, Mass. The nearest port of entry is Plymouth, Mass. The nearest light-house is Minots Light, about 5 miles distant.

The accompanying commercial statistics have been furnished by the ollector of customs at Plymouth, Mass.

The dates and amounts of the appropriations for this work are as ollows:

Act of—		Act of—	
March 2, 1829	$180	August 5, 1886	$10,000
August 30, 1852	1,000	August 11, 1888	5,000
June 14, 1880	7,500	September 19, 1890	10,000
March 3, 1881	10,000	July 13, 1892	10,000
August 2, 1882	10,000		
July 5, 1884	10,000	Total	73,680

Appropriations since 1880 have been expended in accordance with he present project.

Money statement.

uly 1, 1892, balance unexpended		$150.00
mount appropriated by act approved July 13, 1892		10,000.00
		10,150.00
une 30, 1893, amount expended during fiscal year		6,429.84
uly 1, 1893, balance unexpended		3,720.16
uly 1, 1893, outstanding liabilities	$1,189.43	
uly 1, 1893, amount covered by uncompleted contracts	2,206.82	
		3,396.25
aly 1, 1893, balance available		323.91
Amount (estimated) required for completion of existing project		217,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		40,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for rubble stone for Scituate Harbor, Massachusetts, opened Sep[illegible] ber 9, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid per ton of 2,000 pounds.	Total tons can be delivered at price bid.	Rem[illegible]rks.
1	Joseph H. White, Boston, Mass	$2.47	3,643	Lowes[illegible] bid.
2	C. T. Derry & Co., Boston, Mass	2.69	3,347	

The contract was awarded to Mr. J. H. White, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, none; 1892, $31.50; 1893, none.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign			1	100	2	205
Domestic	38	3,800	29	3,000	22	3,080
Clearances:						
Foreign			1			
Domestic			29			

Imported.	1891.	1892.	1893.
Coal.....tons..	2,500	3,000	2,500
Lumber.....feet..	4,000	1,500,000	1,000,000
Lime.....casks..		250	1,000
Bricks		25,000	150,000
Miscellaneous			*1,000

* Barrels herring.

Coasting vessels drawing from 7 to 11 feet frequent the harbor.

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which runs generally parallel to the mainland and about 1 mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join

about the center of the harbor opposite the town wharves, and form the main ship channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $179,766.90, of which there has been expended to June 30, 1892:

For beach protection	$122,553.77
For dredging	45,719.83
Total	168,273.60

On June 30, 1892 the improved channel was 2,286 feet long, 130 feet wide; the basin was 866 feet long, 150 feet wide; both were 9 feet deep at mean low water. Long Beach was in fair condition, but additional bulkheads were needed on its southern end.

On July 18, 1892, it was recommended that of the available funds $2,000 be reserved for necessary repairs to the works protecting Long Beach; that $2,500 be expended in making repairs and extensions to the works on the southern part of the beach, and that the balance of the funds be expended in widening the improved channel to 150 feet, thus completing the proposed dredging. This was approved July 22, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for the dredging. The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with the National Dredging Company, of Wilmington, Del., to dredge 12,000 cubic yards from the improved channel.

Operations under this contract were commenced in December, 1892; were suspended January, February, and March, 1893; resumed and satisfactorily completed in April, 1893. A total of 14,998 cubic yards were dredged under this contract.

No other operations were in progress during the fiscal year.

At the date of this report all of the dredging for the improvement of the harbor which has been proposed is completed.

Some repairs and extensions of the existing works protecting Long Beach are necessary.

A small sum should always be available for the harbor to immediately repair any damages made by storms to Long Beach. These necessary repairs have, in the last twenty years, averaged $1,500.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1873	$3,000.00
March 3, 1825	5,712.00	June 23, 1874	5,000.00
March 25, 1826	13,184.90	March 3, 1875	10,000.00
April 23, 1830	1,850.00	June 18, 1878	5,000.00
March 2, 1831	2,820.00	March 3, 1879	3,500.00
July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00	July 13, 1892	9,500.00
March 3, 1871	10,000.00		
June 10, 1872	2,500.00	Total	179,766.90

Money statement.

July 1, 1892, balance unexpended	$2,292.65
Amount appropriated by act approved July 13, 1892	9,500.00
	11,792.65
June 30, 1893, amount expended during fiscal year	5,094.41
July 1, 1893, balance unexpended	6,698.24
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging from Plymouth Harbor, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	National Dredging Co., Wilmington, Del	29	$15	$3,480	Lowest bid.
2	Augustus R. Wright, Portland, Me	38	3	4,560	
3	Augustus B. Martin, Boston, Mass	40	10	4,800	
4	Charles H. Souther, Boston, Mass	30½	5	4,380	

The contract was awarded to the National Dredging Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, $73,536.29; 1892, $73,808.36; 1893, $47,330.06.

Shipping.	1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*
Entrances:				
Foreign	2	196	3	286
Domestic	103		108	
Clearances:				
Foreign	9	1,817	8	1,721
Domestic				

Imported.	1891.	1892.	1893.
Coal tons..	18,065	16,861	19,094
Iron do...	1,973	1,443	650
Lumber feet..	6,160	8,303,463	2,085,000
Sand tons..		295	140
Miscellaneous do...	330	1,145	2,173

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

B 18.

IMPROVEMENT OF HARBOR AT KINGSTON, MASS.

Kingston Harbor is one of the three divisions which together constitute Plymouth inner harbor. North of it, at a distance of 3 miles, is Duxbury Harbor, and 4 miles south Plymouth Harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company Wharf.

The object of the improvement is to obtain a channel of approach to this wharf.

The project for the improvement of Kingston Harbor was submitted May 25, 1891. It proposed to dredge a channel 4,000 feet long, 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company Wharf, at an estimated cost of $10,000.

The act approved July 13, 1892, appropriated $10,000 for this work.

On July 18, 1892, it was recommended that the available funds be expended in completing the improvement; this was approved July 25, 1892.

On August 6, 1892, an advertisement was issued inviting proposals for this work. The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with the National Dredging Company, of Wilmington, Del., to dredge 30,000 cubic yards.

Operations under this contract were commenced in April, 1893, and satisfactorily completed in June, 1893.

The improved channel is at the date of this report 100 feet wide, 6 feet deep at mean low water, or as proposed by the project.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry; the nearest light-house is Duxbury Pier Light.

Commercial statistics are included in the statement for Plymouth, Mass.

But one appropriation has been made for this work, viz: By the act of July 13, 1892, $10,000.

Money statement.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	1,374.54
July 1, 1893, balance unexpended	8,625.46
July 1, 1893, outstanding liabilities	7,563.10
July 1, 1893, balance available	1,062.36

Abstract of proposals for dredging from Kingston Harbor, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	National Dredging Co., Wilmington, Del.	24	$15	37,500	Lowest bid.
2	Charles H. Souther, Boston, Mass	38½	5	23,376	
3	Augustus R. Wright, Portland, Me	44	3	20,454	
4	Augustus B. Martin, Boston, Mass	46	10	19,565	

The contract was awarded to the National Dredging Company, with the approval of the Chief of Engineers.

B 19.

IMPROVEMENT OF HARBOR AT WELLFLEET, MASS.

Wellfleet Harbor is situated on Cape Cod Bay, 12 miles southeast of Provincetown Harbor, Massachusetts.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, p. 478.

The harbor consists of an outer anchorage south of Smalleys Bar, and an inner harbor north of same bar.

The outer harbor is sufficiently capacious, free from obstructions, and protected to meet the present demands of commerce; but the inner harbor, although capacious and perfectly protected, had no low water navigable connection with the town wharves.

It was, in the original condition of the harbor, 4,200 feet from the 6-foot contour to the wharves, and not to exceed 6 inches draft could be carried to them at mean low water.

The original project for the improvement of this harbor was submitted November 3, 1871. It was based on the survey provided for in the act of January 31, 1871.

It proposed to dredge two channels, each 150 feet wide and 4 feet deep at mean low water, one 2,060 feet long to reach Central and Commercial wharves, and one 1,400 feet long to reach Mercantile Wharf. It was also proposed to remove 204 cubic yards of sunken rocks. The cost of this project was estimated to be $30,000.

On November 28, 1887, a revised project was submitted. It was

based on the survey provided for in the act of August 5, 1886. It proposed to dredge a channel from the Deep Hole to the town wharves, 6 feet deep at mean low water, 100 feet wide, and 4,200 feet long, at an estimated cost of $24,000.

The total appropriations for this harbor to date have been $16,000.

By the act of—	
June 10, 1872	$5,000
August 11, 1888	7,000
September 19, 1890	4,000
Total	16,000

The total amount expended to June 30, 1892, was $11,350.37, and the condition of the improvement was as follows: Mayo, Bay, Lobster, and Lumpfish rocks had been removed, and a channel had been dredged from the Deep Hole to the town wharves, 4,200 feet long, 4 feet deep at mean low water, and 25 feet wide. Opposite the town wharves the channel was enlarged to 75 feet wide, to facilitate the docking of vessels.

The act of September 19, 1890, appropriated $4,000 to continue this improvement. No appreciable benefit to commence would result by the expenditure of this amount, and it is to be retained in the Treasury until additional funds are provided.

To complete the improvement will require an appropriation of $22,000, all of which could be expended to advantage during the fiscal year ending June 30, 1895.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Barnstable, Mass.

Wellfleet is in the collection district of Barnstable, Mass., of which Barnstable is the port of entry. The nearest light-house is Mayo Beach Light.

Money statement.

July 1, 1892, balance unexpended	$4,649.63
July 1, 1893, balance unexpended	4,649.63
Amount (estimated) required for completion of existing project	22,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	22,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, $231.40; 1892, $91.60; 1893, $53.00.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign						
Domestic						
Clearances:						
Foreign					1	78
Domestic	1	74				

Imported.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
Coal	1,250	1,200	1,000
Lumber	500		100
Merchandise		200	80
Miscellaneous		100	10

Vessels drawing from 6 to 12 feet frequent the harbor.

B 20.

IMPROVEMENT OF HARBOR AT PROVINCETOWN, MASS.

Provincetown Harbor is situated at the extremity of Cape Cod, about 40 miles southeast from Boston Light. It is one of the most valuable harbors of refuge on the Atlantic coast. The entire commerce of New England and a very large local fishing interest are directly benefited by its maintenance, which depends entirely on the preservation of the sandy beaches which inclose it.

Since 1826 the project has been a general one, and provides for the preservation of the harbor by building dikes, bulkheads, and sandcatches, and extensive planting of beach grass to repair or prevent storm damages to the beaches.

From the nature of the work it can at no time be considered completed.

A full history of the improvement will be found in the Annual Reports of the Chief of Engineers for the years 1876, 1879, and 1886. A special dike across House Point Island Flats, to be built contingently, was recommended in the Annual Report for 1886.

A plan of the harbor was published in the Annual Report of the Chief of Engineers for 1886.

The total appropriations for this harbor to date have been $152,918.4[illegible]

The amount expended to June 30, 1892, was $147,635.09.

The condition of the several works of preservation in this harbor on June 30, 1892, was as follows:

Long Point.—This long, narrow, low point forms the southeastern limit of the harbor. It was in good order, but to more fully protect the light-house lot at its easterly end the breakwater should be extended 100 feet farther to the northwest.

Abel Hill Dike.—This dike was built to prevent the rush of water from Lanceys Harbor over House Point Island Flats into the main harbor. The rapid wearing away of the southern sand spit that formed Lanceys Harbor had threatened to make a breach through the beach south of the dike. To guard against this, brush and wooden sandcatches had been built on the outer beach opposite the west end of the dike. The dike and sand catches were in good order.

House Point Island Flats.—These flats remained essentially unaltered from the condition shown by the last survey, and as stated in the Annual Report for 1887, it still appears unnecessary to commence the dike projected to be built across these flats.

Beach Point, High Head Dike, and Cove Section.—These works were all in good order.

During the fiscal year no active operations were in progress, and, at the date of this report, all of the works of preservation are in good order with the exception of the brush and wooden sandcatches at the west end of Abel Hill Dike. These need repairs, for which the available funds will suffice.

The nature of the works of preservation of the harbor requires a small sum to be always available for immediate repairs. Such necessary repairs have averaged $1,500 per annum.

The prospective benefit to commerce is the preservation of an important harbor of refuge.

The accompanying commercial statistics have been furnished by the deputy collector at the port of Provicetown, Mass.

Provincetown is a port of entry in the collection district of Barnstable, Mass.; the nearest light-houses are Wood End and Long Point lights.

ates and amounts of appropriations for this work are as fol-

9, 1826	$3,500.00
2, 1829	3,500.00
2, 1831	2,050.00
3, 1832	4,600.00
28, 1834	4,400.00
3, 1835	4,400.00
2, 1836	4,400.00
7, 1838	4,500.00
st 30, 1852	5,000.00
23, 1866	43,068.44
28, 1866	8,000.00
3, 1871	6,000.00
10, 1872	5,000.00
3, 1873	6,000.00
23, 1874	6,000.00
Act of—	
March 3, 1875	$5,000.00
August 14, 1876	4,000.00
June 18, 1878	1,000.00
March 3, 1879	1,000,00
June 14, 1880	500.00
March 3, 1881	5,000.00
August 2, 1882	5,000.00
July 5, 1884	2,000.00
August 5, 1886	3,000.00
August 11, 1888	7,000.00
September 19, 1890	7,500.00
July 13, 1892	1,500.00
Total	152,918.44

Money statement.

92, balance unexpended	$3,783.35
ppropriated by act approved July 13, 1892	1,500.00
	5,283.35
1893, amount expended during fiscal year	42.40
93, balance unexpended	5,240.95
; (estimated) required for completion of existing project	1,500.00
; that can be profitably expended in fiscal year ending June 30, 1895	1,500.00

ted in compliance with requirements of sections 2 of river and
r acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

of revenue collected, 1891, $1,932.75; 1892, $571.47; 1893, $492.77.

Shipping.	1891.		1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
	55	9,232	44	6,358	56	8,781
c	16	2,000	13	756	14	800
	27	5,500	26	2,919	22	2,627
c	10	2,000	18	4,466	27	6,750

Imported.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
	5,000	6,000	6,500
			1,500
		300	
	2,000	7,140	1,500
		500	
		80	
		1,500	
ns	9,300	740	3,800

ses and nationalities of vessels visit the harbor for shelter or with cargo.
sand vessels entered the harbor during the year.

B 21.

IMPROVEMENT OF HARBOR AT CHATHAM, MASS.

Chatham Harbor is at the eastern end of Nantucket Sound, about 15 miles east of Hyannis, Mass. Its outer anchorage, known as Chatham Roads, is a capacious, deep, unobstructed harbor of refuge from northerly and easterly gales.

The inner harbor, locally known as "Stage" Harbor, is small, but well landlocked. It is about one-half mile long, 500 to 600 feet wide, and has 8 to 12 feet depth at mean low water. Its entrance was originally obstructed by three bars on which the depth at mean low water did not exceed 4 feet. The mean rise or fall of the tide is 5 feet.

The project for the improvement of the inner harbor was submitted December 19, 1890, and was based on a survey made in October, 1890. It proposed to dredge a channel 6 feet deep at mean low water through the three obstructing bars, 100 feet wide at the inner bar, 150 feet wide at the middle bar, and 200 feet wide at the outer bar, at an estimated cost of $10,000.

But one appropriation has been made for this work, viz: By the act of September 9, 1890, $5,000.

The total expenditures to June 30, 1892, were $4,402.15.

On June 30, 1892, the improved channel through the middle and inner bars is 100 feet wide, 6 feet deep at mean low water. At least 5 feet could be carried into the harbor at mean low water. Nothing had been done on the outer bar.

No operations were in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1892.

To complete the improvement will require an appropriation of $5,000, all of which could be expended to advantage during the fiscal year ending June 30, 1895.

Chatham Harbor is in the collection district of Barnstable, Mass., of which Barnstable is the port of entry; the nearest light-house is Hardings Beach light.

The accompanying commercial statistics have been furnished by the collector of customs at Barnstable, Mass.

Money statement.

July 1, 1892, balance unexpended	$597.85
July 1, 1893, balance unexpended	597.85
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

Imported.	1891.	1892.	1893.
	Tons.	*Tons.*	*Tons.*
Coal	3,000	3,000	2,(
Iron			
Grain			1,
Lumber	1,000	1,000	1,
Miscellaneous		4,000	1,

Vessels of all kinds drawing from 2 to 10 feet enter the harbor for shelter or w cargo.

B 22.

LIMINARY EXAMINATION OF GLOUCESTER HARBOR, MASSACHUSETTS, FROM FIVE POUND ISLAND TO HEAD OF RIVER.

[Printed in House Ex. Doc. No. 70, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED SATES ARMY,
Washington, D. C., December 5, 1892.

R: I have the honor to submit the accompanying copy of re
d October 27, 1892, by Lieut. Col. S. M. Mansfield, Corps of En
s, of the results of a preliminary examination of Gloucester Har
Massachusetts, from Five Pound Island to head of river, made to
ply with the requirements of the river and harbor act approved
13, 1892.

is the opinion of Lieut. Col. Mansfield, concurred in by this office,
the locality is worthy of improvement by the General Govern-
t, and an estimate of $400 is submitted as the cost of the survey
ssary to the preparation of plan for its improvement.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

on. S. B. ELKINS,
Secretary of War.

EPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 27, 1892.

ENERAL: In accordance with requirements of letter from your
e of July 14, 1892, I have the honor to submit the following report
n the examination of Gloucester Harbor, Massachusetts, from Five
nd Island to head of river, as provided in section 6 of the river and
or act approved July 13, 1892.

his region is the upper portion of the busy harbor of Gloucester
lies just above and in continuation of the portion of the harbor
raced in the approved project for dredging to a depth of 15 feet at
n low water. The shore of the harbor and island is entirely occu-
with wharves.

table showing the business transacted in this region, which aggre-
s $3,422,000 during the past year, is submitted herewith.

he chief difficulty in navigation is due to a reef which makes out
1 Five Pound Island at its southerly end, narrowing the channel
veen the island and John Pew & Son's wharves to about one-half
natural waterway, leaving a contracted passage to the wharves
ve, especially when vessels are lying at the wharves, as is most fre-
ntly the case, even to the number of three or four abreast. Ves-
are occasionally injured on this reef, and it is claimed to be a serious
ger to navigation and should be removed.

, however, lies just on the southerly edge of the projected improve-
t of Gloucester Harbor. Above the water shoals gradually to the
l of the harbor (or river), where it is further desired that the depth
omewhat increased by dredging, some of the wharf owners having
ady dredged about their wharves at their own expense.

In consideration of the large amount of business done, and number of vessels frequenting this district, I am of opinion that it is worthy of improvement by the General Government, and estimate that $400 will be required to enable me to make a survey and report, including a project with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

Table showing business transacted in Gloucester Harbor, Massachusetts, between Five Pound Island and head of river, October 27, 1892.

Name of firm.	Amount of business.	Value of property.	Number of vessels owned.	Value of vessels owned.	Number of men on vessels.	Vessels discharging.	Number of men employed on wharf.	Salt landed hogsheads.	Size of vessels, aggregate.	Business.
									Tons.	
John Pew & Son...	$1,000,000	$70,000	18	$85,000	830	40	100	*10	24,600	Fish and importers of salt.
Daniel Allen & Son.	200,000	20,000	12	48,000	560	35	20	4,500	2,900	Fish-curers.
Geo. Perkins & Son.	400,000	5,000			500	50	40	2,500	3,000	Packers and distributor of fish.
W. H. Jordan	290,000	15,000	15	90,000	270		12	4,200	1,600	Curers of fish and outfitters.
W. H. Perkins	85,000	7,000			660	55	8	2,000	3,500	
D. C. & H. Babson.	150,000	30,000	10	70,000	160		10	2,000	1,200	Curers of fish.
Geo. Todd	40,000	18,000			105	15	14		6,400	15 vessels, 5,000 tons coal and wood.
S. Smith & Co.....	210,000	30,000	14	90,000	{300 225	{30 }	12	4,000	3,500	Curers and outfitters.
D. B. Smith & Co..	200,000	28,000	16	80,000	{200 240	{25	15	3,500	2,500	Do.
Brainard Low.....	150,000	12,000			400	40	10	1,500	2,800	Smokers and packers.
W. H. Andrews ...	12,000	7,000					6			Spar-maker.
Higgins & Gifford.	35,000	15,000					30			Boat-builders.
B. F. Witham & Co.	50,000	14,000			210	18	15	500	1,000	Packers and distributors.
Shute & Merchant.	500,000	32,000	1	7,000	250	25	65	1,000	2,000	Smokers and distributors.
W. H. Wouson 3d..	100,000	14,000			340	20	14	1,500	2,500	Do.
Totals	3,422,000	317,000	86	470,000	5,250	353	371	27,200	57,500	5,000 tons coal and wood.

*Cargoes.

B 23.

PRELIMINARY EXAMINATION OF VINCENT COVE, GLOUCESTER HARBOR, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 56, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated October 27, 1892, by Lieut. Col. S. M. Mansfield, Corps of En-

gineers, of the results of a preliminary examination of Vincent Cove, Gloucester Harbor, Massachusetts, made to comply with provisions of the river and harbor act approved July 13, 1892.

Lieut. Col. Mansfield is of opinion that the cove is not worthy of improvement by the General Government, and I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 27, 1892.

GENERAL: In accordance with the requirements of letter from your office of July 14, 1892, I have the honor to submit the following report upon the examination of Vincent Cove, Gloucester Harbor, Massachusetts, as provided in section 6 of the river and harbor act approved July 13, 1892.

This is a small inlet on the west side of the harbor, half way between Harbor Cove and the head of the river. It is encased in wharves upon which is transacted various businesses, fish-curing, coal and wood, and shipbuilding.

There seems to be no great demand for its improvement, and I have failed to secure any statement of the amount of commerce carried on there. The cove is so small as to be little more than a slip for vessels. It is said that if it be improved it would afford access for a larger class of vessels.

The approved project for the improvement of Gloucester Harbor contemplates a channel of 15 feet at mean low water across the mouth of the cove.

I am of opinion the cove is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 24.

PRELIMINARY EXAMINATION OF SAUGUS RIVER, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 98, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated October 27, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers, of the results of a preliminary examination of Saugus River, Massachusetts, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Mansfield, concurred in by this office, that Saugus River is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 27, 1892.

GENERAL: In accordance with the requirements of letter from your office of July 14, 1892, I have the honor to submit the following report upon the examination of Saugus River, Massachusetts, as provided for in section 6 of the river and harbor act approved July 13, 1892.

Saugus River enters Lynn Harbor, Massachusetts, from the westward, flowing through marsh land. Its valuable portion for commercial purposes is below the turnpike crossing, about 12,000 feet from its mouth. About 6 feet depth at mean high water can be carried to a small coal dock at this crossing. About 3,200 feet below the turnpike is the bridge of the Eastern Railroad, and between the latter and the bridge of a branch of the Eastern Railroad (6,000 feet), and on the northern bank is located the new and extensive factories of the General Electric Company, which has built a wharf and is now engaged in dredging the river to accommodate the shipment of coal and heavy products of their works. About 1,000 feet below the latter bridge is the crossing of the Boston, Revere Beach and Lynn Railroad.

It is thought the present improvements being made by the Electric Company will satisfy all the demands of commerce in the near future, and I am of opinion that the river is unworthy of improvement by the General Government.

I have to add that the approved project for the improvement of Lynn Harbor contemplates the expenditure of the last appropriation therefor, of $10,000, in dredging the bars at the entrance of the river to a depth of 8 feet at mean low water.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

B 25.

PRELIMINARY EXAMINATION OF CHELSEA RIVER, MASSACHUSETTS, FROM GRAND JUNCTION RAILROAD BRIDGE TO BOSTON AND MAINE (EASTERN DIVISION) RAILROAD BRIDGE.

[Printed in House Ex. Doc. No. 40, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated October 26, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers,

of the results of preliminary examination of Chelsea River, Massachusetts, from Grand Junction Railroad Bridge to Boston and Maine (Eastern Division) Railroad Bridge, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Mansfield, concurred in by this office, that the river is worthy of improvement by the General Government.

It is estimated that $400 will be required to make a survey and report, including project, with estimate of cost of the improvement proposed.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS.
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 26, 1892.

GENERAL: Pursuant to the requirements of letter from your office of July 14, 1892, I have the honor to submit the following report upon the examination of Chelsea River, from Grand Junction Railroad Bridge to Boston and Maine (Eastern Division) Railroad Bridge, as provided in section 6 of the river and harbor act approved July 13, 1892.

Chelsea River empties into Boston Harbor, near the mouth of the Mystic River, and carries 20 or more feet of water at low tide to Grand Junction Bridge, and for a short distance above, within the limits of this examination, when it shoals rapidly to the head of the stream, where it is crossed by the Boston and Maine (Eastern Division) Railroad Bridge. The distance between the bridges is, by the thread of the river, about 7,500 feet, and its width for about three-fourths of the length, 300 feet, when it narrows to 100 feet beyond.

The Chelsea side of this stream is admirably adapted to manufacturing purposes, and harbor lines are laid down there in recognition of this fitness for manufacturing and commercial uses.

No wharves are to be found there now save in the small inlet of Bass Creek, but the large manufacturing establishments of the Suffolk Cordage Company, the Revere Rubber Company, and Forbes Lithograph Manufacturing Company are located on this shore, and their facilities for transportation would be greatly advanced by a little improvement of the navigable capacity of the river.

The town of Revere borders the river at its upper end, and a wharf has recently been constructed there for handling coal and building materials, affording the only water communication that Revere possesses.

The eastern shore is limited by the Eastern Railroad, along which the harbor line is established, and presents no desirable water front.

The projectors of the improvement desire a channel of greater capacity in width and depth, and I think the demand is a reasonable one.

I submit copies of letters in relation thereto, embracing all the information attainable as to the present and prospective demands of commerce, and for the reasons stated will say that the river is worthy of improvement by the General Government.

LETTER OF MR. GEORGE F. PROCTOR.

REVERE, MASS., *October 15, 1892.*

DEAR SIR: In reply to yours of September 28, concerning the wishes of the petitioners for improvement of Chelsea River, the present amount of commerce, etc., I will state that the petitioners desire the proposed improvement to enable them to receive their various kinds of merchandise by the cheapest means of transportation, and do believe that a depth of water, as petitioned for, will enable the manufacturing establishments to obtain their fuel at the lowest figure by water shipments; the citizens of Revere their building materials, now received by rail at high rates, the town having doubled its population within ten years, showing the demand for building materials alone. The item of fuel is also to be considered, the town using from 8,000 to 10,000 tons of coal per annum. This is all brought to town either by rail from tide water at Mystic River at a rate which is the same as could be obtained recently by vessel from New York to Boston or by team from tide water at Chelsea.

The article of cord wood is in great demand for manufacturing as well as for domestic purposes, and upwards of 2,000 cords are consumed annually, largely Nova Scotia wood, and, with the exception of a cargo just landed at our own wharf, has been hauled by team from Chelsea and East Boston wharves. An instance of high railroad freight rates is shown on the item of iron water pipe, the rate from Boston to Revere being double that by water from New Jersey ports to Boston.

The article of baled hay, of which Revere probably uses 1,000 tons, could be landed by water at a saving of about $1 per ton.

We believe that 18 feet of water at mean high tide is necessary to ship our fuel, lumber, and all building materials, lighter draft vessels being obtainable only at higher rates of freight; in fact, at the present time, we find it hard to charter coal vessels of moderate tonnage on 12 feet draft.

With the large frontage on the Chelsea side of the river awaiting development for wharf purposes, the plants of the Revere Rubber Company and the Forbes Lithograph Manufacturing Company, both of which you probably have heard from, the town of Revere with its rapid growth, all tend to show the need of good tide-water facilities, and we do believe that ten years from to-day, if the proposed improvement is made, a business on Chelsea River will have developed which will equal that of much larger places, and will prove conclusively to our Government that such an expenditure would not be thrown away.

I inclose a letter from our board of selectmen and would be glad to give you any further information which you may desire.

I remain, very respectfully, yours,

GEORGE F. PROCTOR.

Lieut. Col. S. M. MANSFIELD.

B 26.

PRELIMINARY EXAMINATION OF EAST BOSTON CHANNEL, MASSACHUSETTS, FROM THE SOUTHEASTERLY LINE OF THE LOCATION OF THE BOSTON, REVERE BEACH AND LYNN RAILROAD TO THE CHANNEL AT JEFFRIES POINT, SO CALLED.

[Printed in House Ex. Doc. No. 55, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated October 27, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers, of the results of a preliminary examination of East Boston Channel, from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad to the channel at Jeffries Point, so called, made to comply with the provisions of the river and harbor act approved July 13, 1892.

Lieut. Col. Mansfield is of opinion that the locality is worthy of

improvement by the General Government, and he states that it will require $200 to make a survey and report, including project, with estimate of cost of improvement proposed.

I concur in his views.

Very respectfully, your obbedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 27, 1892.

GENERAL: In accordance with the requirements of letter from your office of July 14, 1892, I have the honor to submit the following report upon the examination of East Boston Channel, from the southeasterly line of the location of the Boston, Revere Beach and Lynn Railroad to the channel at Jeffries Point, so called, as provided in section 6 of the river and harbor act approved July 13, 1892.

The immediate interests to be subserved are the owners and occupants of several wharves around and between Jeffries Point and the railroad. The principal business carried on about Jeffries Point is the curing of fish, and the locality is the only one in Boston Harbor fitted for this purpose.

When vessels of lighter draft than at present were engaged in the trade, this interest was of a very considerable importance and apparently is now, though conducted with great difficulty, owing solely to the lack of deep-water transportation.

Coal in considerable quantities was formerly delivered in vessels to meet the manufacturing demands of the Boston Forge Company, at their wharf adjoining the railroad, and to the Bardwell, Anderson & Company, furniture manufacturers, which has now, for lack of a channel of deep water, to be teamed across the peninsula at a burdensome expense.

It is impossible to give any exact statement of the business of this locality. The Boston Forge Company is the largest concern, and state that they have done a business of $10,000,000 during the past twenty-seven years, and now employ about one hundred men, with $150,000 invested in their plant. Their water front is at present useless to them.

I inclose copies of letters of the Boston Forge Company and of the Bay State Packing Company and others interested in the development iof this district, and respectfully refer to them for information respecting the present and prospective commerce. Undoubtedly this region would increase in value and commercial importance were a channel of deep water dredged along its front sufficient to afford access to vessels of moderate draft.

The range of the tide is about 10 feet. At low water the area, which is a portion of what is called Noddle Island Flats, is almost entirely bare and lies within the established harbor lines of the port of Boston.

I am of opinion the district is worthy of improvement by the General Government.

It will require $200 to enable me to make a survey and report,

including a project, with estimate of the cost of the proposed improvement.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieutenant-Colonel of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER OF GEORGE C. FITZPATRICK & CO.

[Bay State Packing Company, Geo. C. Fitzpatrick & Co., proprietors.]

EAST BOSTON, *October 21, 1892.*

DEAR SIR: The subject of a channel around Jeffries Point, East Boston, is a vital one, in that it affects the commerce of Boston to a great extent, and has also, in a large measure, a bearing on the proper development of the fishing, lumber and coal interests of Boston, more particularly the former. The advantages to be gained by such an improvement are many and varied.

We take the liberty of naming a few of them, showing, as they most surely do, the great improvements and development it would make in the industries and commerce of Boston and East Boston, which, for some years past, has been on the decrease.

As the business carried on around Jeffries Point is, more than anything else, the fish business, it seems to us that it might appropriately rank first on the list of industries. With the present condition of things it is impossible for an ordinary fishing vessel to come to any wharf on the point. A shallow vessel might perhaps come up all right, but the general run of vessels are now being built after the Burgess type, of deep draft of water. This state of affairs in numberless cases sends fish that might be used in Boston to Gloucester, owing to lack of a proper channel to bring the vessel to the wharves of the East Boston curers.

The lumber interests, which are now concentrated on the westerly and northwesterly side of the island, could be extended to the point, there being large tracts of land now vacant which could be used for the building of sheds and warehouses.

Also, in the case of the coal industry: Two large concerns on Jeffries Point, the Boston Forge Company and Bardwell & Anderson, use hundreds of tons of coal annually, which all has to be hauled to their sheds on teams, where if a channel were dredged, barges might come to their wharves and discharge.

We have spoken with different men in the trade associations of Boston, notably the president of the Boston Chamber of Commerce, men directly interested in the improvement of the commerce and resources of the city of Boston, and they have, one and all, agreed that a channel such as we mention would be of almost incalculable benefit to Boston. The very high price of wharf property in the city proper would prevent the fish-curing industry as an investment being a profitable one, whereas the wharf property on Jeffries Point being cheap enables an industry to get a start, and if proper improvements were made, the firms now engaged in it could more than double their business, owing to the fine railroad facilities which are afforded by the near vicinity to the grand junction of the Boston and Albany and Boston and Maine railroads.

We think the points we have enumerated cover ground enough, so that you may understand the manner in which such a project is thought of by those men who have the improvement of Boston at heart, and trust you will give this matter your serious consideration.

We remain, yours, very respectfully,

GEO. C. FITZPATRICK & CO.

Col. MANSFIELD,
Lieutenant-Colonel, Engineers.

LETTER OF GEORGE C. FITZPATRICK & CO.

[Bay State Packing Company, Geo. C. Fitzpatrick & Co., proprietors.]

EAST BOSTON, *October 15, 1892.*

DEAR SIR: We are engaged in the salt-fish business in East Boston and own a wharf property on Maverick street, containing 66,000 feet of land. We handle about $300,000 worth of goods a year and are obliged to pay teaming on all of this,

an expense which would be almost entirely avoided had we a channel in the rear of our wharf where vessels might come alongside and land their fish. We could handle all the salt we use in like manner, where we now pay cartage on that. Had we a channel we would very soon be able to increase our business, thereby necessitating increasing our wharf area. We could engage extensively in the salt herring trade—send vessels to Newfoundland in the fall for trips. You can readily see the great advantage a channel would be to us. It means that we could double our business, and, where we now employ from twenty-five to thirty-five men, could give employment to many more. It would mean, we might say, like opening a new market for fish. Vessels that now take their trips to Gloucester would sell here if suitable accommodations could be provided for them in the way of berths and the like. You will confer a favor and numberless benefits to ourselves and the other firms engaged in the trade in this part of East Boston by doing all in your power to further our petition.

We remain, very respectfully, yours,

GEO. C. FITZPATRICK & CO.

Col. MANSFIELD,
Colonel, Engineers.

LETTER OF JAMES EMERY, JR., & CO.

BOSTON, MASS., *October 18, 1892.*

DEAR SIR: We are doing a large amount of salt-fish business on Bowker's Wharf, East Boston, and owing to the water in the channel being so shallow, we find it impossible to get our fishing vessels alongside of the wharf to discharge their cargoes. We would respectfully suggest that the channel be dredged out so that the vessels can be got up to the wharf. By so doing we think it would be a great help to the fish business in East Boston.

Very respectfully, yours,

JAMES EMERY, JR., & CO.

Col. MANSFIELD.

LETTER OF R. G. LOFTUS & CO.

BOSTON, MASS., *October 17, 1892.*

DEAR SIR: We are engaged in the salt-fish business, and handle about $150,000 worth of fish a year. We believe that if a suitable channel was dredged our business would more than double. At the present time you can not bring any of the modern fishing vessels to any of the wharves, which fact considerably interferes with the proper development of the salt-fish industry of Boston. We sincerely hope that a channel will be dredged.

Yours, truly,

R. G. LOFTUS & CO.

Col. MANSFIELD.
Lieutenant-Colonel of Engineers.

LETTER OF BARDWELL, ANDERSON & CO.

BOSTON, *October 17, 1892.*

DEAR SIR: Replying to your favor recent date, would say that a ship channel would be of great benefit to the commerce of Boston. We could increase our business if we could land on our property the lumber and coal we use, as well as deliver our product direct to vessels.

Respectfully,

BARDWELL, ANDERSON & CO.

Col. S. M. MANSFIELD.

PETITION.

BOSTON, MASS., *October 15, 1892.*

DEAR SIR: We, the undersigned wholesale fish dealers of Boston, believing that the lack of a channel around Jeffries Point works much against the proper development of the fish business in East Boston, do most earnestly request that a proper channel be dredged around that point.

John R. Neal & Co, D. N. Freeman Co., Gloucester Fish Co., J. Burns & Co., P. H. Pew, E. A. Rich & Co., J. Adams & Co., O. H. Wiley & Co., N. G. Stone & Co., Freeman & Cobb, Baker, Witherell & Co., Rich & Story, Conquest & Hodgkins, Story & Stevens, Blanchard & Towle, Boston Fish Co., F. C. Goodspeed & Co., Lombard & Curtis, Haskins Fish Co., Arnold & Winsor, B. F. Phillips & Co., Snow & Rich, Taylor Mayo, J. W. Marston & Co., Coleman, Son & Co., F. J. O'Hara & Co., P. Grimes & Co., J. W. Penlins, James Emery, jr., & Co.

Col. MANSFIELD.

LETTER OF MR. GEO. C. FITZPATRICK.

EAST BOSTON, *October 21, 1892.*

DEAR SIR: The captains of the vessels named on this list have been waited upon by the undersigned, and we have filled in their names, with value of vessel they command, with their full sanction and approval.

We remain, yours, respectfully,

GEO. C. FITZPATRICK.

Col. MANSFIELD,
Lieutenant-Colonel, Engineers.

PETITION.

BOSTON, MASS., *October 18, 1892.*

DEAR SIR: We, the captains of vessels, now selling our fish in Boston, do most earnestly request that a channel be dredged around Jeffries Point, East Boston, to increase the market for fish and thereby very greatly increase the commerce of Boston.

BOSTON VESSELS.

Schooner.		Value.
Edith Emery	P. Sullivan	$10,000
Mary G. Powers	M. Powers	13,000
Loring B. Haskell	Frank Cabral	10,000
Emma W. Brown	A. Drummond	10,000
Sylvester Whalen	S. Whalen	13,000
Julia E. Whalen	B. Whalen	12,000
Allen H. Jones	Frank Dunn	8,000
Sarah H. Prior	Frank Raymond	10,000
Hattie S. Phillips	J. Campbell	11,000
Cora Lee	Frank Perry	6,000
Emily P. Wright	Geo. O'Neil	8,000
W. P. O'Hara	M. Leonard	9,000
Nellie Dixon	John Carney	12,000
Belle J. Neal	J. Driscoll	11,000
Mary L. Harty	C. Foley	6,000
James Drinan	Dan Sullivan	6,000
Lydia Harvey	John Clancy	7,000
Emma E. Witherell	Loring Gayton	12,000
Unique	J. Lawrence	9,000
Total		183,000

PROVINCETOWN VESSELS.

Schooner.		Value.
Gracie H. Benson	J. Harvender	$1,000
Sea Fox	Tony Silva	1,000
Success	J. E. Freeman	000
Julia Costa	M. Costa	1,000
Ruth M. Martin	A. Martin	1,000
Clara S. Cameron	S. Weste	1,000
Joseph P. Johnson	M. Abner	1,500
Rosie Cabral	Jos. Cabral	1,750
M. B. Stetson	W. Wolf	1,000
Marshall L. Adams	Jos. Bragg	1,500
Nellie G. Adams	J. G. Silva	1,000
J. J. Merritt, jr	J. Swazier	1,000
Governor Russell	E. Crowell	1,500
Susan R. Stone	Jos. Stewart	1,000
Daniel Boone	J. Newcomb	1,000
Schuylkill	S. Newcomb	1,500
Nellie M. Snow	N. Williams	1,000
Frank Foster	C. Foster	1,000
Addison Center	A. Cahoon	1,000
Gertie S. Winsor	J. Paige	1,000
Carrie E. Phillips	M. Keaton	1,000
Longwood	T. Green	1,500
Ada K. Damon	A. Azuli	1,000
Joseph A. Manta	M. Gracia	1,000
Total		235,250

GLOUCESTER VESSELS.

Maggie and Lily	M. Silva	$7,000
Gloriana	S. Smith	12,000
Chas. W. Parker	H. Johnson	11,000
Ella F. Bartlett	Tom O'Donnell	3,500
Leader	John Coney	6,500
S. R. Lane	John Josephs	8,500
Abbie A. Snow	J. Perry	7,500
Dixie	B. Hodgdon	7,000
Josie Johnson	Victor Fardig	6,500
Elsie F. Rowe	J. Gannon	8,500
Oceanus	Wm. Lyons	9,000
Geo. A. Upton	B. Corey	8,500
Sarah C. Wharf	Chas. Perkins	4,500
Lottie S. Haskins	Elias Malone	5,500
John Smith	D. Silva	3,000
Sarah	Joseph Corea	4,500
Lizzie J. Jones	Otto Jenson	6,000
Silver Dart	A. Snow	4,500
Mary Fernald	Jos. Garland	7,500
F. R. Walker	J. Nelson	4,500
Annie E. Lane	Frank Howard	6,500
Della F. Tarr	M. Enos	5,000
Horace B. Parker	W. Thomas	11,000
Essex	E. Jones	10,000
Helen F. Whitten	Owen Whitten	13,000
Sterling	E. Joseph	9,000
W. H. Cross	M. Silva	5,500
E. A. Rich	Otto Johnson	12,000
Cavaire	Emmet Stevens	6,500
Shenandoah	Wm. Sweet	5,500
W. H. Crosser	M. Thurlow	6,500
Total		213,000

SWAMPSCOTT BOATS.

Acacia	Ottis Cahoon	$3,500
Jessie	T. A. McLellan	4,500
Hattie F. Knowlton	Sol Wiley	5,000
Little Katie	H. Cahoon	4,500
Minnehaha	R. Horton, sr	3,500
Golden Rule	R. Horton, jr	3,500
Florence Nightingale	J. Haley	4,500
Pluribustah	C. Kehoe	4,500
Ettie	Amos Glase	3,000
Carrie F. Roberts	N. Newcomb	4,000
Jennie P. Phillips	E. Doane	5,000
Total		45,500

ROCKPORT BOATS.

Schooner.		Value.
Lucy E.	Jos. Coney	$4,500
Clara R. Harwood	Frank Coney	4,000
Clara M. Littlefield	Marion Coney	3,500
Livonia	Geo. Stevens	3,500
Eva Nichols	C. Smith	4,000
Defiance	W. Bailey	4,000
Lady of the Lake	T. Donahue	5,000
Quickstep	S. Tarr	4,500
Total		33,000

Col. MANSFIELD.

LETTER OF MR. JAMES SMITH, PRESIDENT BOSTON FORGE COMPANY.

BOSTON FORGE COMPANY,
East Boston, October 20, 1892.

SIR: Your communication of the 11th instant I have received, and in answer respectfully submit the views of the promoters of the contemplated improvement at Jeffries Point, as I understand them.

Their object is to develop the wharf property adjacent to the proposed channel, which is not now available on acconnt of the shallow depth of water in front of them.

My opinion, as well as that of intelligent persons conversant with this property, is that such improvement would open up a long wharf front that would be of great benefit to the general public, the manufacturing, coastwise, and fishing interests; it would enable the manufacturers in this vicinity to receive their coal, iron, lumber, and other water-borne materials with greater facility, and conduce to the encouragement of commerce and trade.

There is already established here a very considerable fish-curing trade, that will serve as a nucleus for a much larger business when vessels of comparatively deep draft of water can come to these wharves.

Recently there has been manifested by the fish dealers of Boston much interest in this proposed improvement, and they assert positively that, in the event of its completion, these wharves will become the receiving and distributing depot, to a great extent, of the fish trade of Boston.

The amount of commerce that would be benefited by this improvement it would be difficult, if not impossible, to estimate with any degree of certainty, but it is fair to assume that it would be quite large, because of the proximity of these wharves to two of the largest railroads in New England and the main channel of Boston Harbor.

I can not more specifically answer the queries of your letter, but when these improvements are completed, doubtless this location will become of considerable importance to the maritime and manufacturing interests of Boston.

Yours respectfully,

JAMES SMITH.

Lieut. Col. S. M. MANSFIELD,
Corps of Engineers, U. S. A.

LETTER OF THE BOSTON FORGE COMPANY.

BOSTON FORGE COMPANY,
East Boston, October 20, 1892.

SIR: Replying to your communication of the 11th instant, will state that the Boston Forge Company bought their wharf January 21, 1866; erected buildings and started their furnaces May following.

We chartered two-masted schooners and landed our coal, fuel, sand, kaolin, and other supplies on our wharf until 1873, when two vessels grounded on the flats, which had to be lightered (this was caused by the gradual filling in of the flats), after which the owners objected to charter to our wharf, and we have ever since been obliged to pay wharfage and cartage, which amounts on the average to $2,500 per annum. This outlay is a great detriment in close competition with other manufacturers who have water facilities, and gives no encouragement for further outlay.

We have at present $150,000 invested in our plant, and if the contemplated improvement is made could add greatly to our works.

We have done a business during the past twenty-seven years of $10,000,000; at present we have about 100 employés.

It would be of great benefit to all the abutters and add largely to the commercial and manufacturing interests of Boston.

Yours respectfully,

JAMES SMITH, President.

Lieut. Col. S. M. MANSFIELD,
Corps of Engineers, U. S. A.

B 27.

PRELIMINARY EXAMINATION OF NEPONSET RIVER, MASSACHUSETTS.

[Printed in House Ex. Doc. No. 35, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated October 31, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers, of the results of a preliminary examination of Neponset River, Massachusetts, made to comply with provisions of the river and harbor act approved July 13, 1892.

Lieut. Col. Mansfield states that in his opinion the river is worthy of improvement by the General Government, and he submits an estimate of $500 as the amount required to make the surveys necessary to the preparation of plan and project with estimate of the improvement proposed.

I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 31, 1892.

GENERAL: In accordance with the requirements of letter from your office of July 14, 1892, I have the honor to submit the following report upon the examination of Neponset River, Massachusetts, as provided in section 6 of the river and harbor act approved July 13, 1892.

The Neponset River flows chiefly through marshy banks from the head of navigation, at the dam at Lower Mills, to Dorchester Bay, a distance of about 2½ miles, and forms the dividing line between Dorchester (Boston) on the north and Milton and Quincy on the south.

The natural conditions of the region are most favorable for the establishment of manufactories and the handling of coal, lumber, stone, etc. United States harbor lines have been established between the mouth of the river at Commercial Point and the Neponset Avenue

lge, and the bank on the northern side below the bridge is now ıpied by the large Bay State Gas Company's works and several ırves, where is conducted a large business in coal and building ma- als.

he river is crossed by three bridges having convenient draw open- ;, and several coal and lumber docks are located on both banks at ′er Mills.

am indebted to Messrs. A. and J. R. Churchill for statistics of the iness of the river, and submit herewith a copy of their letter, with a densed tabular statement of the business of the river during the t ten years, which embraces only that done above the bridges.

here is also herewith copies of letters from the A. T. Stearns Lum- Company and Messrs. Pratt & Co., doing business below the lges.

ı my opinion the river is worthy of improvement by the General ′ernment, and estimate that $500 will be required to enable me to ɪe a survey and report, including a project with estimate of the cost he proposed improvement.

Very respectfully, your obedient servant,

S. M. MANSFIED,
Lieut. Col. of Engineers.

ɔrig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER OF MESSRS. A. AND J. R. CHURCHILL.

BOSTON, *October 22, 1892.*

EAR SIR: In the matter of the petition by O. S. Godfrey and Henry L. Pierce and ɔrs for the improvement of the Neponset River, Massachusetts, we desire to sub- the inclosed tables showing a part of the business upon said river for the last ten ɔs; with also a comparative recapitulation thereof showing the increase through e years.

′e call your attention especially to the following points:

he volume of business in coal has increased about 50 per cent. In lumber the ıme of business has more than doubled. In brick it has trebled.

ıt more important is it still to notice that the tonnage of vessels has been in- sing from an average in 1882 of 389 to 423 (tons coal) in 1891. The largest in being 612.

is indeed chiefly this consideration, beside the increase in business, that justi- the appeal of the petitioners, viz, that coal, etc., is being shipped and will con- ıe to be shipped in larger and larger vessels necessitating, of course, deeper and er draft.

is desirable to-day to import coal in vessels of 800, 900, and even 1,000 tons bur-

he necessity of the future is still greater.

eantime large business interests like the Walter Baker chocolate business and grain business of Mr. Samuel Gannett are dependent upon the river and its ac- modations for coal and grain; and others like the paper business of the Tileston Hollingsworth corporation will be benefited by facilitating and increasing the ısportation of coal by the river.

he petitioners hope for your favorable consideration of this matter, and we shall ɡlad to explain these figures to you, if necessary, at your convenience.

Yours, very truly,

A. & J. R. CHURCHILL.
Attorneys for Petitioners.

ieut. Col. MANSFIELD,
U. S. Engineer, etc.

Yearly account.

RECAPITULATION.

Year.	Total of cargoes.	Coal.			Lumber.		Brick.	
		Number of cargoes.	Amount.	Average.	Number of cargoes.	Amount.	Number of cargoes.	Amount.
			Tons.	*Tons.*		*M feet.*		*M.*
1882	34	23	8,948	389+	9	1,125+	2	119
1883	34	21	7,961	379+	11	1,127+	2	121+
1884	44	20	7,596	378+	21	1,729	3	180
1885	54	25	9,639	385+	22	2,133	7	441
1886	50	26	9,817	377+	22	2,264	2	122
1887	53	26	10,244	394	24	2,413	3	182
1888	71	38	14,650	385+	22	2,212	11	684
1889	66	41	16,303	397+	25	2,466		
1890	60	33	13,943	422+	23	2,425	4	241
1891	66	35	15,825	423+	25	2,736	6	441
Total for ten years..	532	288	114,926		204	20,630+	40	2,531+

LETTER OF THE A. T. STEARNS LUMBER COMPANY.

NEPONSET, MASS., *October 29, 1892.*

DEAR SIR: Understanding that the matter of the improvement of the Neponset River has been referred to you, we write to urge your favorable report and recommendation of the improvement.

Our business has increased about tenfold during the last ten years, *i. e.*, from 1,200 to 12,000 tons in large vessels per year. During about two months of the year we have, on the average, one vessel per week and the vessels average from 400 to 800 tons each.

On the other hand the channel of the river has been filling up. The current fills up the bends of the river and at the seasons of low-course tides our vessels are obliged to wait from a week to a fortnight before they can get up to our wharf.

We earnestly hope that the proposed improvement will be made.

THE A. T. STEARNS LUMBER CO.
By A. T. STEARNS, *President.*

Col. S. M. MANSFIELD,
United States Engineer.

LETTER OF PRATT & COMPANY.

NEPONSET, MASS., *October 27, 1892.*

DEAR SIR: Replying to your inquiry we beg to say that we have a wharf on Neponset River, where we carry on the lumber business, having from thirty to forty vessels yearly. The deepening and widening the channel would be of great help to all doing business on the river. This improvement has been called for for many years and if the business now done is to be kept more water and wider channel must be had.

Yours truly,

PRATT & COMPANY.

Mr. J. M. B. CHURCHILL.

IMPROVEMENTS

Hyan. Harbor of Refuge at Hyannis, Mass.
Nant. Harbor of Refuge at Nantucket, Mass.
M.V. Marthas Vineyard inner harbor at Edgartown.
V. H. Vineyard Haven Harbor, Mass. (Mass).
Ware. Wareham Harbor, Mass.
N. B. New Bedford Harbor, Mass.
Westp. Westport Harbor, Mass.
Cana.Ch. Canapitsit Channel, Mass.
Taun. Taunton River, Mass.
Pawt. Pawtucket River, R.I.
G.J.S. Green Jacket Shoal, Providence River, R.I.
Prov.R. Providence River & Narragansett Bay, R.I.

Green. Greenw
C.H. Cove & V
Newp. Newport
P. J. Harbor o
P.J.Pond Entranc
B. I. Harbor
Pawc. Pawcat
Ston. Harbor

EXAM
W.H. Woods
Targ.Cove Tarpau
N. B. New Be

WRECKS

Schooner Francis Edwards
Schooner G.S. Tarbell.
Coal Barge Sooloo.
Coal Barge Storm King.
Barge R.A. Allen.
Schooner Charlotte Fish.
Steam Yacht Alva.
Old Wreck in Nantucket Harbor.
Old Wreck in Edgartown Harbor
Stone Schooner at Menemsha Pt.
Schooner Nellie V. Rokes.
Schooner Rogers.
Schooner Bertha J. Fellows
Schooner J.B. Woodbury.

STEAMBOAT LINES

1 CONTINENTAL STEAMBOAT CO.
Providence, Fields Pt., Silver Spring, Riverside.
Providence, Prudence Island, Conanicut Id., Newport.

2 MERCHANTS & MINERS TRANSPORTATION CO.
(PROVIDENCE, NORFOLK & BALTIMORE STEAM
Providence, Norfolk, Newport News, West Point, Baltimo

3 PROVIDENCE & STONINGTON STEAMSHIP CO.
Providence, Newyork (PROVIDENCE LINE)
Stonington, Newyork (STONINGTON LINE)

4 FALL RIVER & PROVIDENCE STEAMBOAT CO.
Providence, Bristol, Bristol Ferry, Fall River.

5 WINSOR LINE
Providence, Philadelphia.

6 STEAMER "QUEEN CITY."
Providence, Tiverton, Sakonnet Pt.

7 STEAMER "H.S. CASWELL."
Newport, Narragansett Pier.

8 WICKFORD LINE (N.B.W.R.R. & ST. BT. CO.)
Newport, Wickford, (R.R. to Newyork.)

9 BLOCK ISLAND LINE
Newport, Block Island.

10 JAMESTOWN FERRY
Newport, Jamestown

11 OLD COLONY STEAMBOAT CO.
Fall River, Newport, Newyork (FALL RIVER LINE)
New Bedford, Woods Holl, West Chop, Vineyard Haven, Cottage
New Bedford, Newyork
Providence, Stonington.

12 NEWYORK & BOSTON STEAMSHIP CO.
Newyork, Boston.

13 MAINE STEAMSHIP CO.
Newyork, East Chop, Portland.

14 MAIL ROUTES
New Bedford to Nonquitt, Cuttyhunk, Woods Holl, Vineyard
Cottage City, Edgartown, Nashuo
Newport to Jamestown, Narragansett, Wickford, Providence,
Block Island to New London.
Stonington to Watch Hill.

15 EXCURSION ROUTES
New Bedford - Gayhead, Gayhead - Falmouth, Falmouth - Co
Falmouth - Woods Holl, Woods Holl - Martha's Vineyard, New Bedfor
Westerly - Watch Hill - Stonington.



COMPILED & DRAWN BY P. BROSIG.



APPENDIX C.

T OF RIVERS AND HARBORS IN SOUTHEASTERN MASSA-S, IN RHODE ISLAND, AND IN EASTERN CONNECTICUT.

APT. W. H. BIXBY, CORPS OF ENGINEERS, OFFICER IN R THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER RELATING TO THE WORKS.

IMPROVEMENTS.

fuge at Hyannis, Mass.
fuge at Nantucket, Mass.
eyard, inner harbor at n, Mass.
neyard Haven, Mass.
arbor, Massachusetts.
Harbor, Massachusetts.
rbor, Massachusetts.
hannel, Massachusetts.
er, Massachusetts.
iver, Rhode Island.
River and Narragansett e Island.
et Shoal, Providence ode Island.
ay, Rhode Island.

14. Cove and waterway near Coaster Harbor Island, Rhode Island.
15. Newport Harbor, Rhode Island.
16. Harbor of refuge at Point Judith, Rhode Island.
17. Entrance to Point Judith Pond, Rhode Island.
18. Harbor of refuge at Block Island, Rhode Island.
19. Pawcatuck River, Rhode Island and Connecticut.
20. Harbor of refuge at Stonington, Conn.
21. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS.

Massachusetts.
ove, Naushon Island, etts.
Harbor, Massachusetts.
arbor, Providence River, nd.
Harbor, Cowesset Bay, nd.
Harbor, Greenwich Bay, nd.

28. Wickford Harbor, Narragansett Bay, Rhode Island.
29. Inner harbor at Point Judith Breakwater, Rhode Island.
30. Breachway into Salt Pond, Block Island, Rhode Island.
31. Stonington Harbor and its entrance, Connecticut.

ENGINEER OFFICE, U. S. ARMY,
Newport, R. I., July 8, 1893.

I have the honor to submit herewith annual reports on harbor works under my charge at the end of the fiscal une 30, 1893.

of this year this office has been assisted by Lieut. W. ps of Engineers, and by Assistant Engineers Edward ohn H. Rostock.

spectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

THOMAS L. CASEY,
hief of Engineers, U. S. A.

C 1.

HARBOR OF REFUGE AT HYANNIS, MASS.

The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod, about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge. (For map, see p. 592, Annual Report of 1884.)

The mean rise and fall of the tide is about 3¾ feet.

Original condition.—Before improvement it was an open roadstead, exposed to southerly storms, with depths varying from 10 to 20 feet in the inner harbor.

In the years 1827–1838 a breakwater of riprap granite, 1,170 feet long, was constructed, covering an anchorage of about 175 acres, the entrance to which had a depth of about 15½ feet. In the years 1852–1882 extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top. About $124,000 was spent on this work, completed in 1882.

At the adoption of the present project the 15.5 feet depth anchorage covered only about 47 acres, and the 34 additional acres to be dredged carried an average of about 12 feet depth of water at low water.

Plan of improvement.—The present approved project, that of 1884, provides for the dredging to 15.5 feet depth at low water of about 34 acres of shoal area north of the existing breakwater, so as to increase the deep-water harborage by that amount; all at a total cost estimated in 1884 at $45,743.20 (including $81.20 left over from a former project).

A plan of the works may be found at p. 560, Annual Report of the Chief of Engineers for 1885; and further information at p. 621 of 1885.

Appropriations.—Upon the present project appropriations have been made as follows: On hand 1884, $81.20; 1886, $10,000; 1888, $10,000; 1890, $8,000; 1892, $6,000. Totals up to June 30, 1893, $34,081.20.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $5.60 of outstanding liabilities) up to June 30, 1892, was $28,081.20, by which 11 acres out of 34 had been dredged.

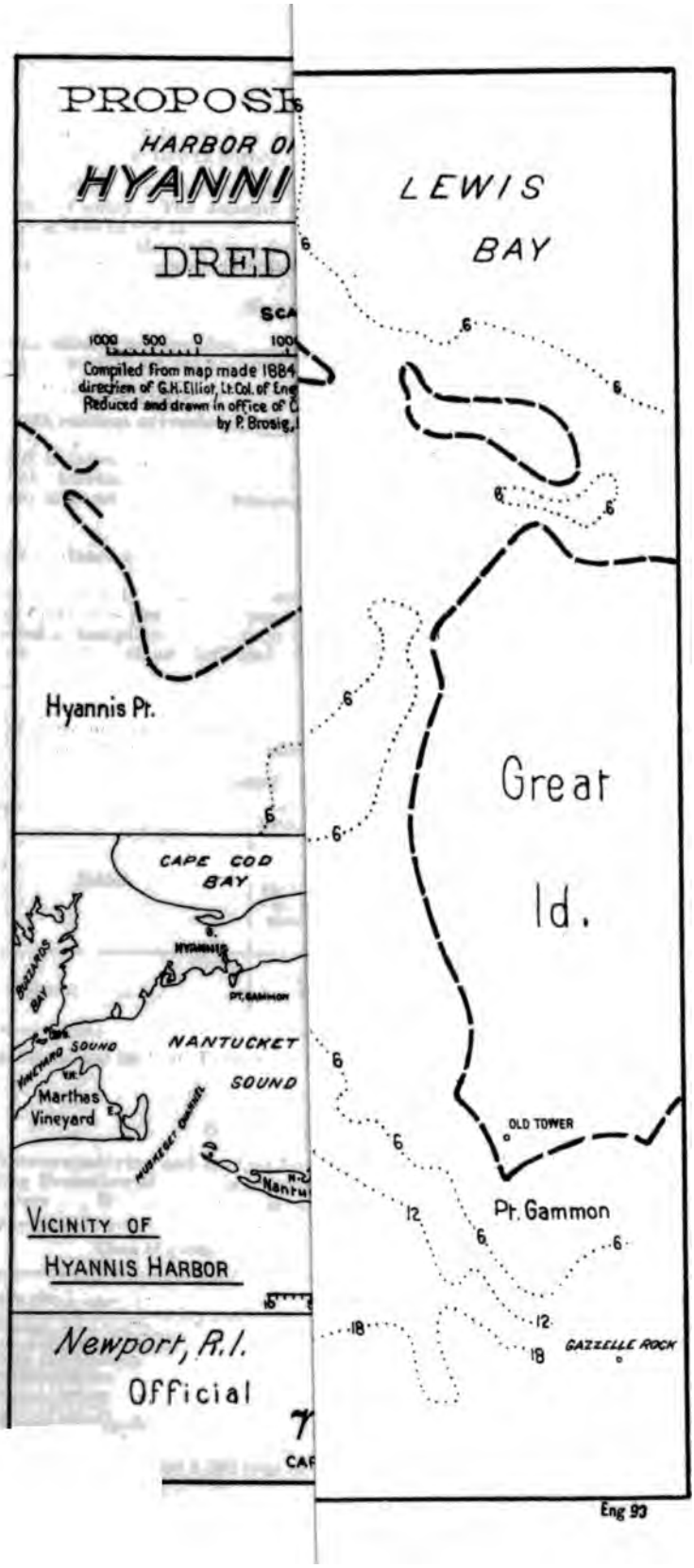
Operations during the past fiscal year.—Value of United States plant, $7,500. Including $66.10 of outstanding liabilities, the expenses of the year were $528.03.

During the year a project has been submitted and approved for work under the new appropriations, and contract for the dredging entered into with J. H. Fenner, of Jersey City, N. J., at 16.5 cents per cubic yard, under date of February 6, approved by Chief of Engineers February 25, 1893, work (together with that at New Bedford) to be commenced by May 1 and completed October 1, 1893. Nothing has as yet been done in the field. The contractor has been delayed in commencing work.

This work was in the local charge of Mr. Edward Parrish as superintendent.

Work required to complete the existing project.—The work required to complete the existing project is the completion of the dredging to a depth of 15½ feet over 22 acres more in the area limited on the west by a line running due north from the western end of the breakwater, and on the north by a line running parallel to the breakwater, and distant 500 feet from it, leaving a berm of 100 feet along its northern side.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand and the funds asked for to


PROPOSE
HARBOR OF
HYANNI
DRED
SCA
1000 500 0 100
Compiled from map made 1884
direction of G.H. Elliot, Lt.Col. of Eng
Reduced and drawn in office of C
by P. Brosig,
Hyannis Pt.
LEWIS
BAY
Great
Id.
CAPE COD
BAY
HYANNIS
PT. GAMMON
BARNSTABLE
BAY
VINEYARD SOUND
NANTUCKET
SOUND
Marthas
Vineyard
NANTUCKET CHANNEL
Nantu
VICINITY OF
HYANNIS HARBOR
OLD TOWER
Pt. Gammon
GAZZELLE ROCK
6
12
18
Newport, R.I.
Official
CAP
Eng 93

the execution of the project above referred to—of deepening the anchorage area inside the breakwater.

Hyannis Harbor is in the Barnstable collection district, and Barnstable is the nearest port of entry. The amount of revenue collected at Barnstable in the last calendar year was $1,026.31.

The main value of the harbor is for a harbor of refuge. The nearest light-house is Hyannis Light; the nearest fortification is the fort at Clarks Point, New Bedford, Mass.

Money statement.

July 1, 1892, balance unexpended		$5.60
Amount appropriated by act approved July 13, 1892		6,000.00
		6,005.60
June 30, 1893, amount expended during fiscal year		467.53
July 1, 1893, balance unexpended		5,538.07
July 1, 1893, outstanding liabilities	$66.10	
July 1, 1893, amount covered by uncompleted contracts	3,600.00	
		3,666.10
July 1, 1893, balance available		1,871.97
Amount (estimated) required for completion of existing project		11,662.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		11,662.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 10, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for dredging in the harbor at Hyannis, Mass.

[Quantity required, about $3,600 worth of work.]

No.	Bidder.	Price bid per cubic yard— On this work alone.	Price bid per cubic yard— In connection with other work.	Remarks.
		Cents.	*Cents.*	
1	J. H. Fenner	19½	16½	Combination bids include work at New Bedford.

Contract awarded to J. H. Fenner, at 16½ cents.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Hyannis Harbor by water during the calendar year ending December 31, 1892, is estimated as follows, based mainly upon reports received from Mr. William Crocker, Hyannis, Mass.:

Class of goods.	Exports.	Imports.	Total.	Tonnage.
Fish, oysters, etc	$10,400	$680	$11,080	190
Vegetables and truck	500		500	30
Grain and forage		95,000	95,000	5,000
Lumber and products		37,000	37,000	1,800
Coal, minerals, and products	7,000	60,000	67,000	13,200
General merchandise		27,000	27,000	450
Sundries		800	800	200
Total	17,900	220,500	238,400	20,900

Gain over last year, about 5,000 tons or $55,000. Transportation lines established during the year, none.

The passage of vessels through the waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	25	10	400
Freight, mainly	50	13	800
Passenger, mainly	10	7	200
Fishing	40	11	250
Tugs	250	9	100
Pleasure boats	550	3	10
Sail:			
Freight	2,500	12	300
Fishing boats	400	3	8
Oyster boats	5	3	6
Pleasure boats, large	160	10	100
Pleasure boats, small	200	4	10

C 2.

HARBOR OF REFUGE AT NANTUCKET, MASS.

Nantucket Harbor is the only large harbor on Nantucket Sound between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis, on the other (the north) side of Nantucket Sound. The navigation of this sound is intricate and dangerous by reason of numerous shoals. Nantucket Harbor has deep water inside, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod, estimated to be 50,000 annually. In the memorial to Congress, on which the first appropriation for this harbor of refuge was based, it was stated that more than 500 vessels had been wrecked in the vicinity of the island. (For map of harbor see p. 423, Annual Report of 1880, and p. 576 of Report of 1885.)

The mean rise and fall of the tide is about 3 feet.

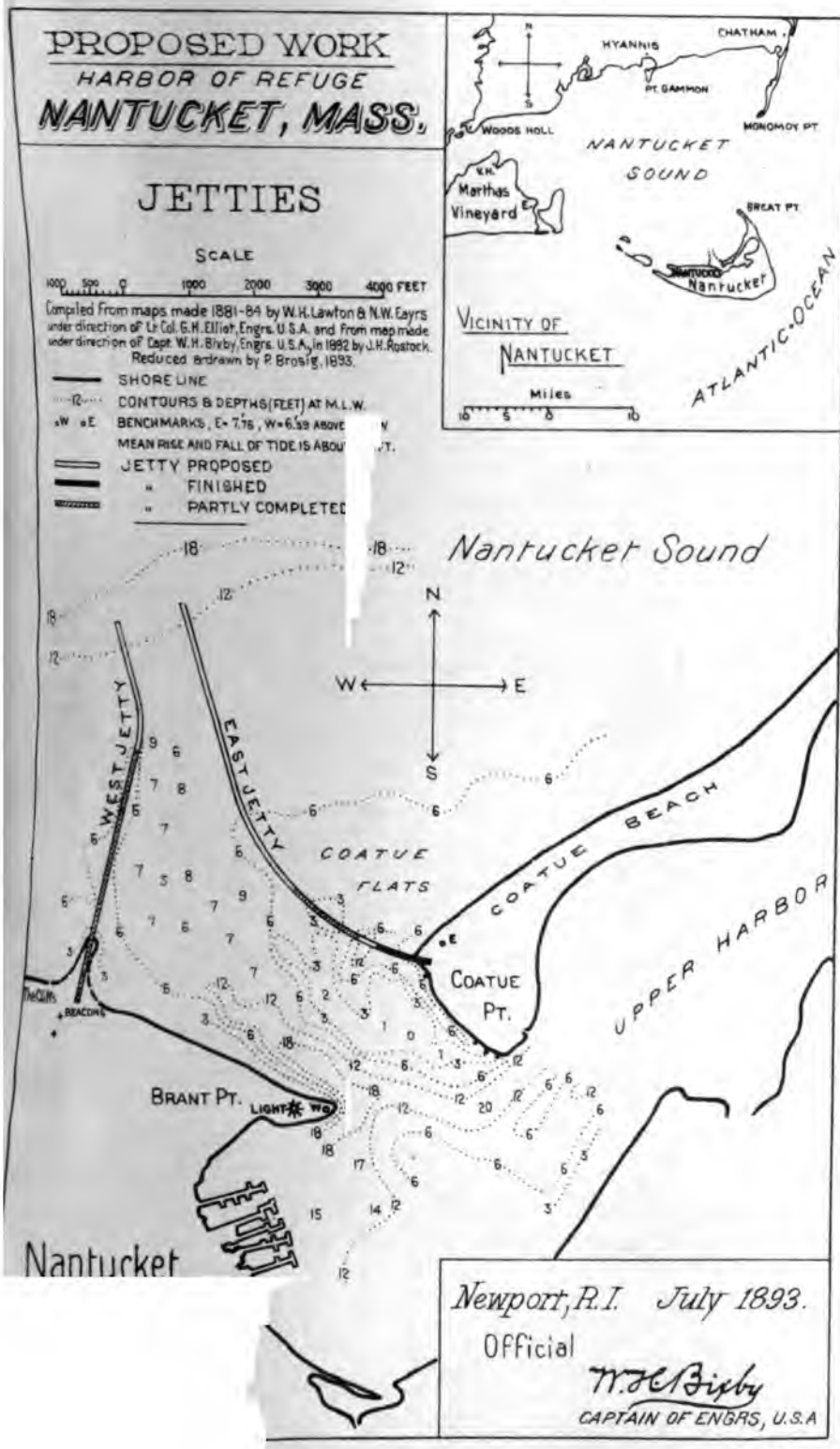
Original condition.—At the adoption of the present project no jetties existed, and the channel entrance was barred by a shoal of 1.5 miles width, on which there was only 6 feet depth of water at low tide, the channel being very crooked and subject to changes in location.

Plan of improvement.—The present approved project, that of 1880, as modified in 1885, provides for the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal current to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of 15 feet at low water in this channel, all at a total cost estimated in 1885 at $375,000.

A plan of the works may be found at p. 578, Annual Report of the Chief of Engineers for 1885, and further information at p. 436 of 1880, p. 544 of 1881, p. 595 of 1884, and pp. 563, 575, 578 of 1885.

Appropriations.—Upon the present project appropriations have been made as follows: 1880, $50,000; 1881, $25,000; 1882, $25,000; 1884, $10,000; 1886, $15,000; 1888, $20,000; 1890, $25,000; 1892, $25,000. Totals up to June 30, 1893, $195,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $113.42 outstanding liabilities) up to June 30, 1892, was $170,000, by which the west jetty had been built to 3,955 feet length with full height; the east jetty had been


PROPOSED WORK
HARBOR OF REFUGE
NANTUCKET, MASS.
JETTIES
SCALE
1000 500 0 1000 2000 3000 4000 FEET
Compiled from maps made 1881-84 by W.H. Lawton & N.W. Eayrs under direction of Lt Col. G.H. Elliot, Engrs. U.S.A. and from map made under direction of Capt. W.H. Bixby, Engrs. U.S.A., in 1892 by J.H. Rostock. Reduced & drawn by P. Brosig, 1893.
SHORE LINE
CONTOURS & DEPTHS (FEET) AT M.L.W.
BENCHMARKS, E- 7.76, W- 6.39 ABOVE
MEAN RISE AND FALL OF TIDE IS ABOU T.
JETTY PROPOSED
" FINISHED
" PARTLY COMPLETED
HYANNIS
CHATHAM
PT. GAMMON
WOODS HOLL
MONOMOY PT
NANTUCKET SOUND
K.H.
Marthas Vineyard
BREAT PT
Nantucket
VICINITY OF NANTUCKET
Miles
10 5 0 10
ATLANTIC OCEAN
Nantucket Sound
N
W
E
S
WEST JETTY
EAST JETTY
COATUE FLATS
COATUE BEACH
UPPER HARBOR
COATUE PT.
BRANT PT.
LIGHT
WQ
Nantucket
Newport, R.I. July 1893.
Official
W.H.C. Bixby
CAPTAIN OF ENGRS, U.S.A

Eng 93

built to 834 feet length with full height; then came a gap of 160 feet, and then 1,300 feet length raised to half-tide level, completing about half the needed work.

Operations during the past fiscal year.—Value of United States plant, $7,000. Including $599.05 of outstanding liabilities the expenses of the year were $2,649.07.

During the year a project had been submitted and approved for work under the new appropriation, bids to be asked for the delivery of stone, modified later to allow of work by hired labor and the use of the Government plant. A minor survey had been completed to serve as a basis for the coming season's work.

A light has been maintained on the west jetty during the year except during July, 1892, when from the exhaustion of the appropriation it had to be left unattended.

This work was in the local charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the extension of the east jetty, the raising of the west jetty in some places, and the excavation by dredging of so much of the channel as may not be excavated by tidal scour.

Operations contemplated for the fiscal year ending June 30, 1894.—The work has been much delayed heretofore by the scour around the end of the jetty, making it necessary to build it in 15 feet of water instead of in 5. According to the present plan it is proposed to build up a considerable length of the jetty to the half-tide level before completing it to the full cross section. The channel appears to be moving continually to the eastward and deepening slightly from year to year.

It is proposed to apply the balance on hand and the funds asked for to the further construction of the east jetty and raising low places in the west jetty, together with a little dredging, if necessary.

Nantucket is in the Nantucket collection district and is a port of entry. There was no revenue collected in the last calendar year. The value of the harbor is mainly as a harbor of refuge. The nearest light-houses are Nantucket Cliff and Brant Point lights. The nearest fortification is the fort at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1892, balance unexpended	$113.42
Amount appropriated by act approved July 13, 1892	25,000.00
	25,113.42
June 30, 1893, amount expended during fiscal year	2,158.64
July 1, 1893, balance unexpended	22,954.78
July 1, 1893, outstanding liabilities	599.05
July 1, 1893, balance available	22,355.73
Amount (estimated) required for completion of existing project	180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. B[illegible] Birby, Corps of Engineers, for stone to be delivered in the jetties at Nantucket Harbor, R[illegible] I.

[Quantity required, about $18,000 worth of work.]

No.	Bidders.	Price bid per ton.				Remarks.
		On this work alone.		In connection with other work.		
		West jetty.	East jetty.	West jetty.	East jetty.	
1	Jas. Scully, Groton, Conn.	$2.60	$2.60	$2.60	$2.50	Combination bids include work at Block Island and Vineyard Haven.
2	Francis H. Smith, New York, N. Y.			2.93	2.83	
3	Jas. V. Luce, Niantic, Conn.	2.60	2.60			

All bids rejected as too high.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Nantucket Harbor by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. Joseph W. Clapp, collector of customs, Nantucket, Mass.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
Fish, oysters, etc	$12,500	$3,000	$15,500	70
Live stock and products		9,000	9,000	28
Vegetables and truck		10,000	10,000	
Grain and forage		28,000	28,000	600
Rice		960	960	6
Tobacco		39,500	39,500	50
Fertilizers		20,000	20,000	1,000
Lumber and products		15,300	15,300	1,500
Coal, minerals, and products		42,000	42,000	7,000
Machinery and hardware		20,000	20,000	150
General merchandise		120,000	120,000	1,500
Sundries		75,000	75,000	1,800
Total	12,500	382,800	395,300	13,[illegible]00

Gain over last year, about 3,000 tons, or $90,000. Transportation lines establish[illegible]ed during the year, sailing packet line (Wm. T. Swain owner) between Nantucket a[illegible]d New Bedford, Mass.

The passage of vessels through this waterway is estimated as follows (each [illegible]n-trance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Aver[illegible]e tonna[illegible]e.
Steam:		*Feet.*	*Tons.*
Freight and passenger *	460	7.5	[illegible]500
Fishing	1	4	50
Tugs	1	4.5	
Sails:			
Freight	3	8	[illegible]00
Fishing boats	12	3	3
Pleasure boats, large	21	4	8
Pleasure boats, small	15	5	

* 16,000 excursion passengers.

C 3.

MPROVEMENT OF MARTHAS VINEYARD INNER HARBOR AT EDGARTOWN, MASS.

The inner harbor at Edgartown lies in the northern part of the waterway or strait that separates Chappaquiddick Island from the east end of Marthas Vineyard. It extends southward about 1½ miles from Chappaquiddick Point, opposite Edgartown, and averages about one-fifth of a mile in width.

This harbor is so completely landlocked as to form a safe harbor of refuge for small vessels, but the contracted width of the entrance and the resulting velocity of the tidal currents make it difficult to pass through. (For map of this harbor see House Ex. Doc. No. 59, of Fifty-first Congress, first session.)

Original condition.—At the adoption of the present project the middle-ground shoal carried only about 6 feet depth of water and was a very troublesome obstruction.

Plan of improvement.—The present approved project, that of 1889, provides for the removal to 10 feet depth at low water of a "middle ground" shoal in the central part of the inner harbor; all at a total cost estimated in 1889 of $4,500.

A description of the works may be found at p. 588, Annual Report of the Chief of Engineers for 1890, and a plan of the same in House Ex. Doc. No. 59, of the Fifty-first Congress, first session.

Appropriations.—Under the present project appropriations have been made as follows: 1890, $2,000; 1892, $2,500. Total up to June 30, 1893, $4,500.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $11.39 outstanding liabilities) up to June 30, 1892, was $1,945.40, by which about half of the shoal had been dredged to full depth.

Operations during the past fiscal year.—Value of United States plant, $200. Including $126.54 of outstanding liabilities, the expenses of the year were $2,448.75.

During the year a project has been submitted and approved for work under the new appropriations, allowing all work to be done by hired labor and the use of the Government plant. A minor survey has been made to serve as a basis for the coming season's work. The dredging (commenced April 21, stopped May 9) has been completed as far as funds would allow; and 9,494 cubic yards of hard sand have been removed from 2,035 feet length and 33 feet width of cutting, and to a depth of at least 10.5 feet at low water, leaving about one-quarter of the original shoal still unremoved.

This work was in the local charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the remaining quarter of the Middle Ground to a depth of 10 feet at mean low water.

The original estimates of Maj. Livermore (p. 588, Annual Report of 1890) placed the cost of work at $4,500, to be expended in one year. The funds, however, were divided between two small appropriations of $2,000 in 1890 and $2,500 in 1892. Had the whole $4,500 been available in 1890 the work would undoubtedly have been completed in 1891 and within the original estimates. Nearly half of each appropriation has had to be spent in putting the dredging plant in repair, moving it

a long distance to the place of work, and (after the field work is ended) moving the plant back to its place of storage and wharfage, and paying for its care during a year of idleness while waiting for the next appropriation. Were plant to have been hired from private parties they would have made the United States pay these expenses either directly or under the guise of rent or contract price. Actual dredging in the field in this particular case cost only about 10 cents per yard under the last appropriation for hard-sand excavation and dumpage; but the rest of the funds have been eaten up by the other matters above alluded to, which would all have been avoided had the total of appropriations been made by Congress in a single lump sum.

In order to complete the unfinished work it will cost about $300 for office work of the next two years; about $1,000 to store, repair, move, and return plant, and about $1,200 to do the remaining dredging, making a total of $2,500 in addition to the small balance still remaining on hand.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand and further appropriations to the completion of the project.

Edgartown is in the Edgartown collection district and is a port of entry. The amount of revenue collected there during the last calendar year was $383.98; the nearest light-house is the Edgartown Light; the nearest fortification is the fort at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1892, balance unexpended	$65.99
Amount appropriated by act approved July 13, 1892	2,500.00
	2,565.99
June 30, 1893, amount expended during fiscal year	2,333.60
July 1, 1893, balance unexpended	232.39
July 1, 1893, outstanding liabilities	126.54
July 1, 1893, balance available	105.85
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The commerce arriving and leaving Edgartown, Marthas Vineyard, by water during calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. C. H. Marchant, collector of customs, Edgartown, Mass.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
Fish, oysters, etc	$3,000	$1,000	$4,000	1,200
Live stock and products	7,200	18,000	25,200	125
Vegetables and truck	3,000		3,000	100
Grain and forage		16,200	16,200	900
Rice		400	400	3
Tobacco		25,000	25,000	30
Cotton and products				2,500
Fertilizers		2,200	2,200	60
Lumber and products		154,000	154,000	8,000
Coal, minerals, and products	500	17,500	18,000	2,500
Machinery and hardware		180,000	180,000	500
General merchandise		950,000	950,000	9,000
Sundries	59,000	9,000	68,000	2,500
Total	72,700	1,373,300	1,482,000	34,400

PROGRESS MAP FOR 1893

MARTHAS VINEYARD INNER HARBOR AT EDGARTOWN, MASS.

FROM 1. JULY 1892 TO 30. JUNE 1893.

MIDDLE GROUND SHOAL

Scale

100 0 500 1000 1500 2000 FEET

Based on map by J.H. Rostock 1889,'93.
made under direction of the Newport U.S. Engineer office.

△ • △ SURVEY STATIONS

SHORE LINE AT M.L.W.

·····12····· CONTOURS AT DEPTHS (FT.) AT M.L.W.

BM. BENCHMARK, 5.206 FT. ABOVE M.L.W.

MEAN RISE AND FALL OF TIDE IS ABOUT 2.0 FT.

DREDGING (TO 10 FT. DEPTH AT M.L.W.) DURING FISCAL YEAR 1892/93.

" " PRIOR TO JUNE 30, 1892

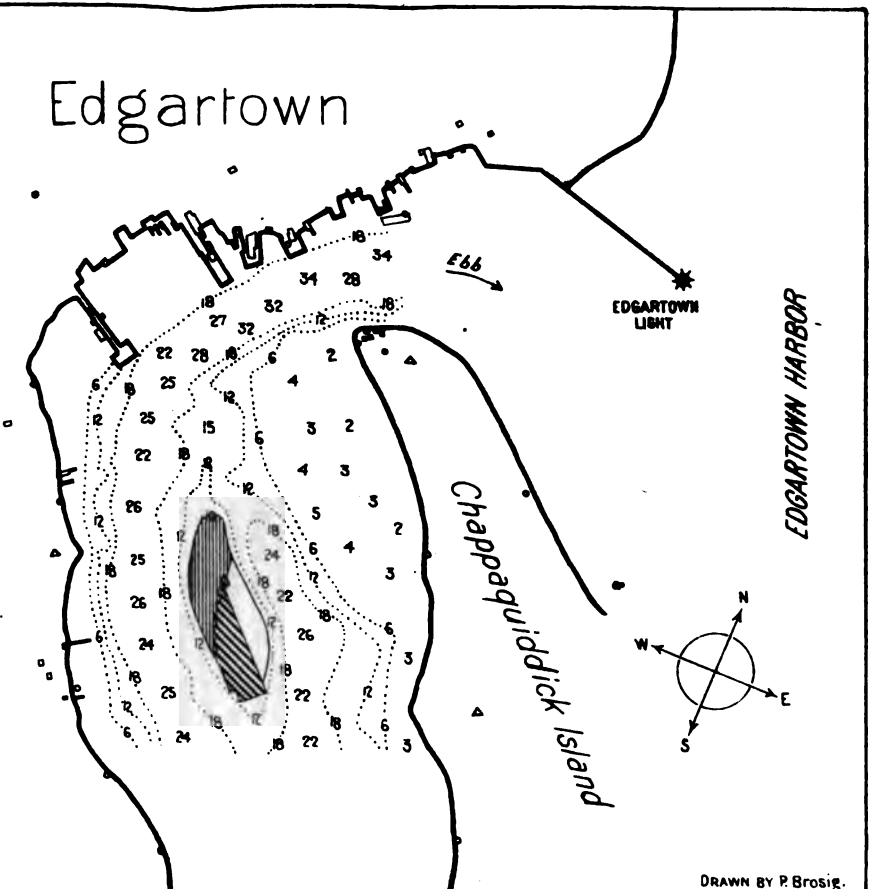
UNCOMPLETED AREA.

Newport, R.I. July 1893

Respectfully submitted

W. H. Bixby

CAPTAIN OF ENGINEERS



Gain over last year, about 4,000 tons, or $160,000; transportation lines established during the year, none.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	235	9	345
Fishing	60	11	120
Tugs	95	9.5	80
Pleasure boats	100	8	112
Sail:			
Freight	790	12	150
Fishing boats	8,850	3.5	9
Pleasure boats, large	750	5	11
Pleasure boats, small	2,400	2	3

C 4.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound. It is triangular in form and faces the northeast. The width of the mouth of the harbor, or the distance between the points of land on the east and west sides of the entrance known as East Chop and West Chop, is about 1¼ miles; and from a line connecting the chops to the narrow southerly end of the harbor, at which is situated the town of Vineyard Haven, the distance is about 1¾ miles. The entire area of the harbor between the shore lines is about 949 acres, of which some 657 acres have a depth of not less than 15 feet. The mean rise and fall of the tide is 1.7 feet.

Original condition.—At the mouth of the harbor the wearing away of the chops by the action of the waves in storms had been noted for many years. The former site of a light-house on West Chop had entirely disappeared. The débris was carried by the current into the harbor, where it formed shoals, which were gradually impairing the anchorage capacity, especially in the upper part or the harbor. (For map of harbor see p. 580 of Annual Report of 1887.)

Plan of improvement.—The present approved project, that of 1887, as modified in 1889, provides for the protection of the "chops" (or headlands) from erosion, and the intervening harbor from being filled by the eroded material; the whole to be done by means of stone sea walls and jetties, to be built along the beach in front of the bluffs at both headlands, all at a total cost estimated in 1882 at $60,000.

A description of the work may be found at p. 594, Annual Report of the Chief of Engineers for 1882, p. 577 of 1887, and p. 612 of 1889.

Appropriations.—Upon the present project appropriations have been made as follows: 1888, $25,000; 1890, $10,000; 1892, $7,500. Total up to June 30, 1893, $42,500.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $44.69 outstanding liabilities) up to June 30, 1892, was $34,948.72, by which there had been built a sea wall of 450 feet length, and a jetty of 50 feet length, at the East Chop; and a sea wall of 400 feet length, 3 jetties of from 80 to 296 feet length, a wharf, and a short breakwater of 60 feet length, at the West Chop; completing about half the needed work.

Operations during the past fiscal year.—Value of United States plant, $3,800. Including $219.05 of outstanding liabilities, the expenses of the year were $1,045.17.

During the year a project has been submitted and approved for work under the new appropriations, and contract for stone work entered into with James V. Luce, of Niantic, Conn., at $2.40 per ton of 2,000 pounds, under date of the 4th of February, approved by the Chief of Engineers March 6, 1893; work to be commenced 1st of May, and to be completed by 1st of July, 1893. A minor survey has been made to serve as basis for the coming season's work. The contractor has reached the place of work but has not yet placed any stone on the sea walls.

This work was in the local charge of Mr. Edward Parrish as superintendent.

Work required to complete the existing project.—The work required to complete the existing project is the completion of these systems of jetties and sea walls at both chops.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand and the funds asked for to continue the work of protection, mainly at the East Chop.

Vineyard Haven is in the Edgartown collection district. Edgartown is the nearest port of entry. The amount of revenue collected at Edgartown in the last calendar year was $383.98. The nearest light-houses are those on East and West Chops. The nearest fortification is the fort at Clark Point, New Bedford, Mass.

Money statement.

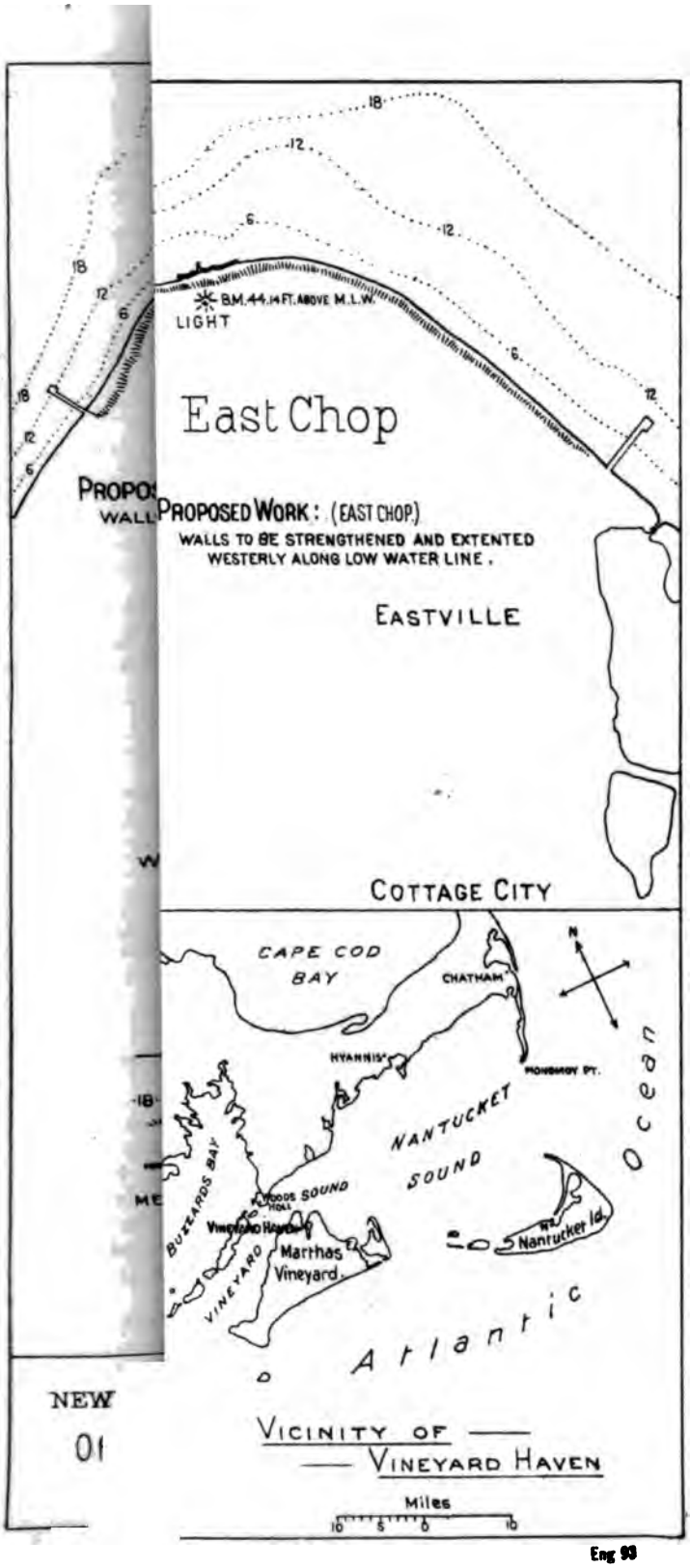
July 1, 1892, balance unexpended		$95.97
Amount appropriated by act approved July 13, 1892		7,500.00
		7,595.97
June 30, 1893, amount expended during fiscal year		870.81
July 1, 1893, balance unexpended		6,725.16
July 1, 1893, outstanding liabilities	$219.05	
July 1, 1893, amount covered by uncompleted contracts	5,000.00	
		5,219.05
July 1, 1893, balance available		1,506.11
Amount (estimated) required for completion of existing project		17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		17,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. Birby, Corps of Engineers, for stone delivered in the sea wall at East and West Chops, Vineyard Haven.

[Quantity required, about $4,000 worth of work.]

No.	Bidders.	Price bid per ton—		Remarks.
		On this work alone.	In connection with other work.	
1	Sames Scully, Groton, Conn	$2.50	$2.50	Combination bids include work at Block Island and Nantucket.
2	Francis H. Smith, New York		2.69	
3	James V. Luce, Niantic, Conn	2.40		

Contract awarded to James V. Luce.


18
12
6
12
6
18
12
6
B.M. 44.14 FT. ABOVE M.L.W.
LIGHT
East Chop
PROPOSED WORK: (EAST CHOP.)
WALLS TO BE STRENGTHENED AND EXTENTED
WESTERLY ALONG LOW WATER LINE.
EASTVILLE
COTTAGE CITY
CAPE COD
BAY
CHATHAM
N
HYANNIS
MONOMOY PT.
NANTUCKET
SOUND
Ocean
BUZZARDS BAY
WOODS SOUND
VINEYARD
Marthas
Vineyard
Nantucket Id.
Atlantic
VICINITY OF
VINEYARD HAVEN
Miles
10 5 0 10

NEW

01

Eng 93

COMMERCIAL STATISTICS.

erce arriving and leaving Vineyard Haven Harbor by water during the ar ending December 31, 1892, is estimated as follows (based mainly upon ived from Mr. Edward C. Lord, Vineyard Haven, Mass.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
te	$36,000	$300	$36,300	500
products	3,500	40,000	43,500	200
l truck	300	5,000	5,300	15
ge		45,000	45,000	2,500
		4,000	4,000	45
		10,000	10,000	15
ducts		10,000	10,000	20
		2,000	2,000	50
roducts		25,000	25,000	2,500
and products		40,000	40,000	8,000
l hardware		5,000	5,000	100
andise		600,000	600,000	5,000
		10,000	10,000	1,500
	39,800	796,300	836,000	20,430

last year, about 4,000 tons or $165,000. Transportation lines estab-g the year, none.

ge of vessels through this waterway is estimated as follows (each d departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
d passenger	1,500	10	600
ainly	200	16	1,000
mainly	50	12	900
	10	10	200
	500	11	100
oats	200	9	200
	7,000	15	500
ats	300	10	150
oats, large	500	10	100
oats, small	200	5	10

C 5.

ROVEMENT OF WAREHAM HARBOR, MASSACHUSETTS.

rbor is an estuary at the head of Buzzards Bay. The object provement is to deepen and widen the channel leading from Bay to Wareham, the industries of which (and of several he vicinity with which it is connected by rail) are chiefly the ire of iron, whose heavy materials and supplies must be ed by water. The commerce of Wareham is carried on in ssels, which require a wide chanuel suited to beating across

r object of the improvement is the raising of Long Beach, h the sands from the bay were washed into the harbor. The and fall of the tide is 4 feet.

l condition.—Before improvement the ruling depth in the is about 7 feet at mean low water, and the channel was nar-ery crooked. Long Beach, a narrow sand spit at the mouth

of the harbor, was washed and abraded by the waves and currents at high water, and the material was carried into and shoaled the channel inside.

Between 1871 and 1875 $40,000 was appropriated to obtain a channel depth of 10 feet in the lower harbor and 9 feet in the upper harbor, and to partially protect Long Beach by brush and stone work. This work was finished in 1876.

At the adoption of the present project the headland of Long Beach was wearing off and the adjacent parts of the channel and harbor were shoaling; the channel depth was limited to 9 feet at low water, this channel being narrow and crooked.

Plan of improvement.—The present approved project, that of 1880, as modified in 1887, provides for the deepening and widening of the channel from Buzzards Bay to Wareham so as to obtain 10 feet depth at low water over 250 feet width from the entrance up to Barneys Point, and thence the same depth over 350 feet width up to Wareham, and for the raising and protecting of Long Beach (the eastern headland of the entrance) so as to prevent the erosion of this beach and the shoaling of the adjacent parts of the channel and harbor; all at a total cost estimated in 1887 at $56,236.

A plan of the works may be found at p. 586, Annual Report of the Chief of Engineers for 1885, and further information at p. 550 of 1881 and p. 542 of 1887.

Appropriations.—Upon the present project appropriations have been made as follows: 1881, $10,000; 1882, $5,000; 1884, $10,000; 1886, $15,000; 1888, $4,000; 1890, $5,000; 1892, $7,236. Total up to June 30, 1893, $56,236.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $144.26 outstanding liabilities) up to June 30, 1892, was $46,865.44, by which the channel had been deepened to half width and full depth of 10 feet in its upper portion, and to less width in its lower portions; and the sand spit had been partly protected by catch-sand fences and brush and stone work.

Operations during the past fiscal year.—Value of United States plant, $5,800. Including $952.55 of outstanding liabilities, the expenses of the year were $5,327.36.

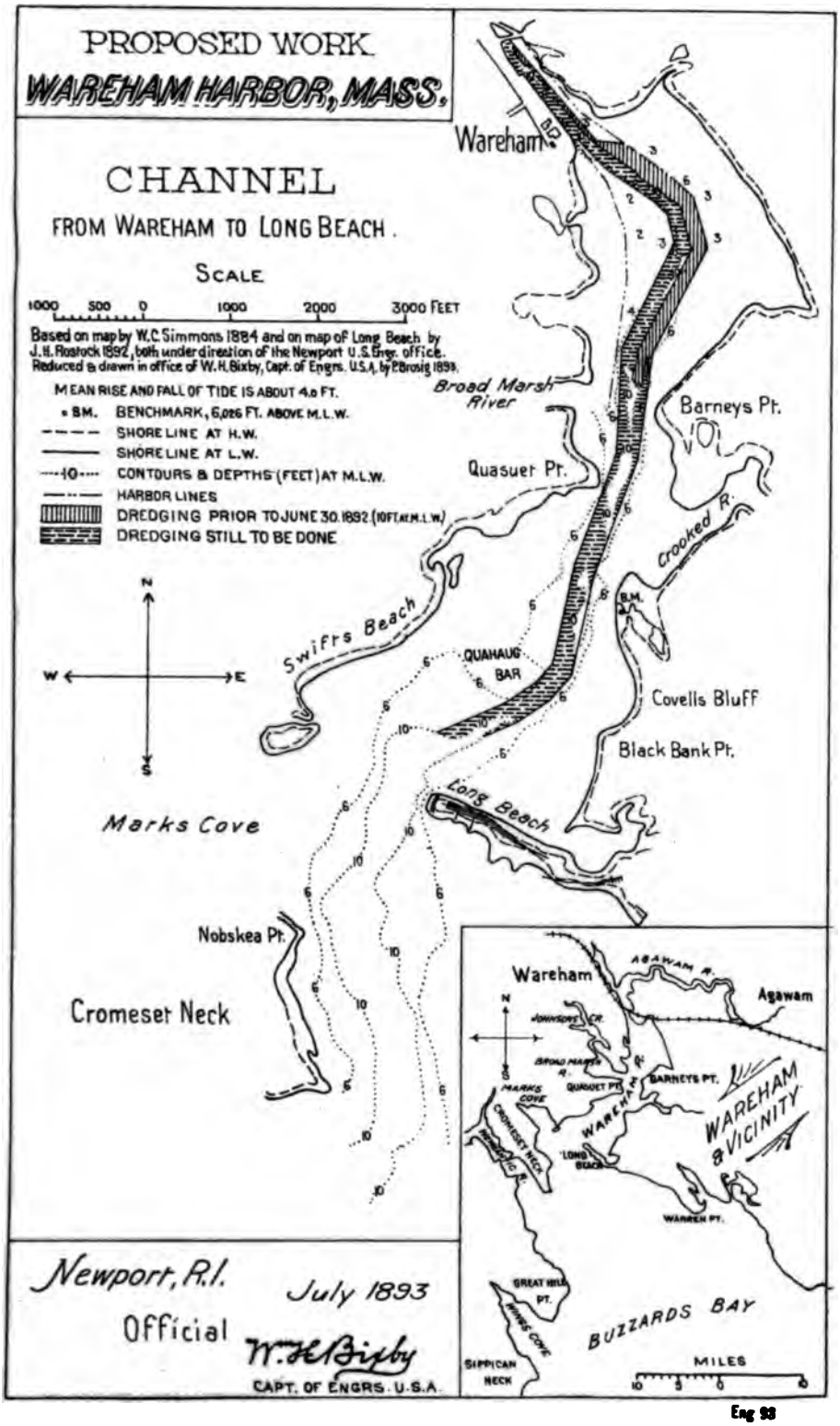
During the year dredging has been continued under contract with J. H. Fenner, Jersey City, N. J., dated February 25, 1891, approved May 18, 1891, and completed on the 7th of July, 1892. A project has been submitted and approved for work under the new appropriations allowing all work to be done by hired labor and the use of the Government plant. A minor survey has been started to serve as basis for the coming season's work. Preparations have been made to resume active field work early in July.

This work was in local charge of Mr. J. H. Rostock as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the channel to its full width and depth down to the deep water above Long Beach.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance of the funds on hand to the completion of the channel and to the further building up of Long Beach.

Wareham is in the New Bedford collection district. New Bedford is the nearest port of entry. The amount of revenue collected at New Bedford in the last calendar year was $86,589.84. The nearest light-houses are Bird Island and Wing Neck lights. The nearest fortification is the fort at Clark Point, New Bedford, Mass.


PROPOSED WORK
WAREHAM HARBOR, MASS.
CHANNEL
FROM WAREHAM TO LONG BEACH.
SCALE
1000 500 0 1000 2000 3000 FEET
Based on map by W.C. Simmons 1884 and on map of Long Beach by J.H. Rostock 1892, both under direction of the Newport U.S. Engr. office. Reduced & drawn in office of W.H. Bixby, Capt. of Engrs. U.S.A. by P. Brosig 1893.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.0 FT.
BM. BENCHMARK, 6.026 FT. ABOVE M.L.W.
SHORE LINE AT H.W.
SHORE LINE AT L.W.
10 CONTOURS & DEPTHS (FEET) AT M.L.W.
HARBOR LINES
DREDGING PRIOR TO JUNE 30. 1892 (10FT. AT M.L.W.)
DREDGING STILL TO BE DONE
N
W
E
S
Wareham
Broad Marsh River
Barneys Pt.
Quasuet Pt.
Crooked R.
B.M.
Swifts Beach
QUAHAUG BAR
Covells Bluff
Black Bank Pt.
Long Beach
Marks Cove
Nobskea Pt.
Cromeset Neck
Newport, R.I.
July 1893
Official
W. H. Bixby
CAPT. OF ENGRS. U.S.A.
Wareham
Agawam R.
Agawam
Johnsons Cr.
Broad Marsh R.
Marks Cove
Quasuet Pt.
Barneys Pt.
Warehan R.
Cromesett Neck
Long Beach
Weweantic R.
Warren Pt.
WAREHAM & VICINITY
Great Hill Pt.
Mikes Cove
Sippican Neck
BUZZARDS BAY
MILES
10 5 0 10

Money statement.

ly 1, 1892, balance unexpended	$2,278.82
ount appropriated by act approved July 13, 1892	7,236.00
	9,514.82
ne 30, 1893, amount expended during fiscal year	4,519.07
ly 1, 1893, balance unexpended	4,995.75
ly 1, 1893, outstanding liabilities	952.55
ly 1, 1893, balance available	4,043.20

COMMERCIAL STATISTICS.

The commerce arriving and leaving Wareham Harbor by water during the calen- r year ending December 31, 1892, is estimated as follows (based mainly upon orts received from Mr. Alden Besse, Wareham, Mass.):

Class of goods.	Exports.	Imports.	Totals.	Tonnage.
				Tons.
h, oysters, etc	$31,000	$9,000	$40,000	10,300
e stock and products		41,000	41,000	380
getables and truck	270,000		270,000	2,600
in and forage	109,000	226,000	335,000	14,300
acco		6,100	6,100	6
nber and products	1,200	52,000	53,200	6,100
l, minerals, and products	530,000	580,000	1,110,000	73,400
chinery and hardware	269,000	79,000	348,000	5,800
eral merchandise	45,000	232,000	277,000	1,900
dries		35,000	35,000	350
Total	1,255,200	1,260,100	2,515,000	115,100

ain over last year, none known. Transportation lines established during the ar, none.

The passage of vessels through this waterway is estimated as follows (each entrance l departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
am, freight and passenger	40	8	300
ges, freight	20	12	250
l:			
Freight	200	12	250
Fishing boats	200	6	

C 6.

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

New Bedford Harbor is an estuary of Buzzards Bay and is the port the cities of New Bedford and Fairhaven, Mass. New Bedford is an portant port of entry. It is largely interested in manufactures, those cotton predominating, and has an extensive commerce in addition its whale fisheries. The population of New Bedford and Fairhaven 1888 was about 38,000.

The object of the improvement is to provide a channel 18 feet deep mean low water.

The mean rise and fall of the tide is about 3 feet.

Original condition.—Before improvement the channel had a ruling depth of about 12½ feet at mean low water.

As early as 1839 some little dredging was done for the improvement of the harbor. The increase of depth obtained, however, was only 2 feet, and the cut but 30 feet wide. A survey of the harbor was made in 1852, but a definite project for its improvement was not made until 1874. The project provided for a channel 200 feet wide and 15 feet deep at mean low water from the deep water just above Palmer Island to the wharves at New Bedford. This project was modified in 1877, increasing the width of channel to 300 feet, and by means of appropriations made in 1875–'76, amounting to $20,000, this project was completed in 1877. Since that time vessels of larger draft have been employed in the harbor, and vessels of 15 feet draft not only now touch the bottom in this channel, but in the channel below Palmer Island, at points not included in the former improvement.

At the adoption of the present project the channel was winding, and only about 15 feet deep.

Plan of improvement.—The present approved project, that of 1887, provides for the deepening, widening, and straightening of the channel from Buzzards Bay to New Bedford, so as to obtain 18 feet depth at low water over 200 feet width and over its entire length; all at a total cost estimated in 1887 at $35,000.

A description of the works may be found at page 514, Annual Report of the Chief of Engineers for 1888, and a plan of the same in House Ex. Doc. No. 86 of the Fiftieth Congress, first session.

Appropriations.—Upon the present project appropriations have been made as follows: In 1888, $10,000; 1890, $10,000; 1892, $7,500; total up to June 30, 1893, $27,500.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $213.79 outstanding liabilities) up to June 30, 1892, was $19,750.93, by which the straight channel had been completed on its western side to 15 feet depth with 80 feet width over its entire length; and a slightly crooked channel of 80 feet width with 18 feet depth also existed over the same distance, wandering a little from the projected channel.

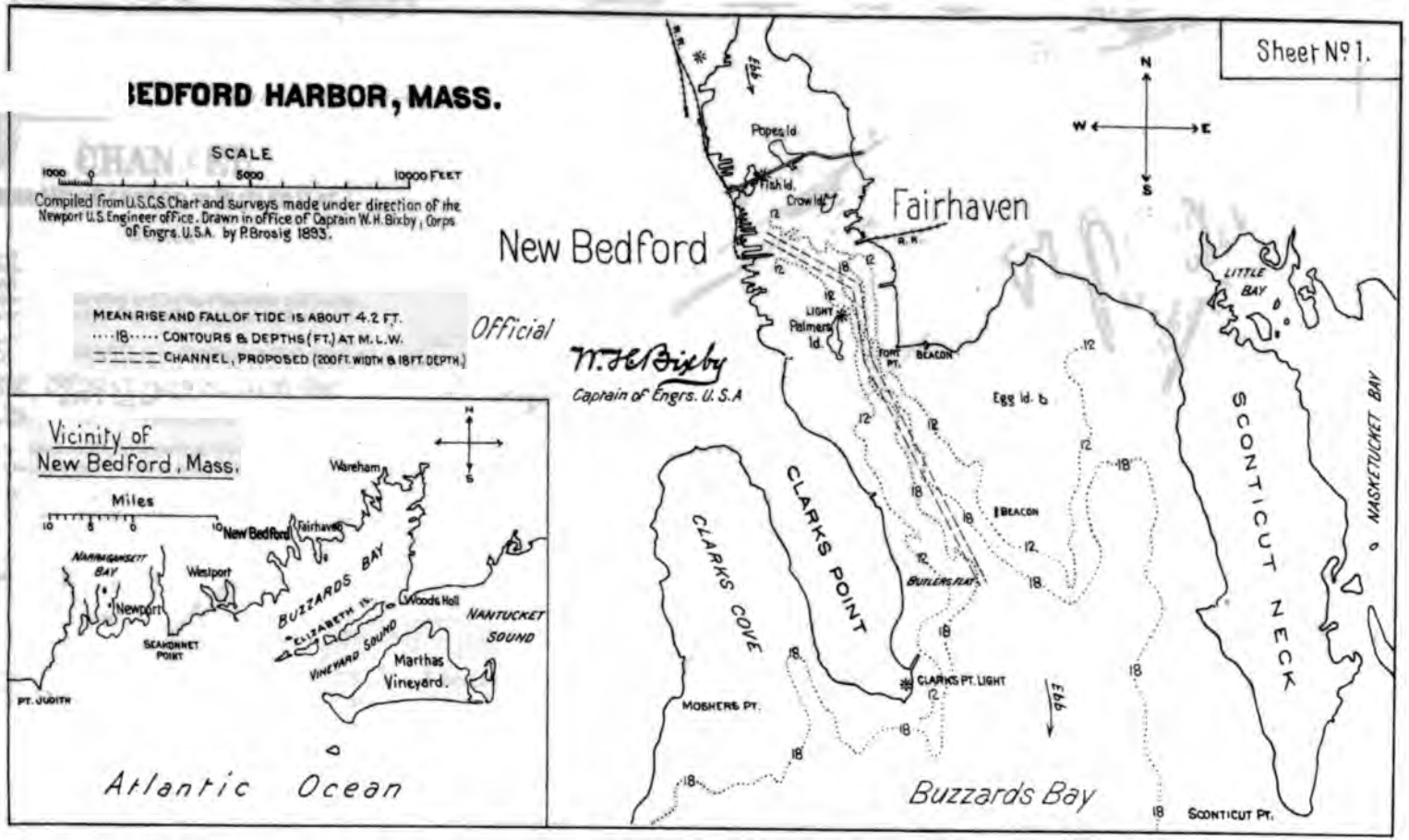
Operations during the past fiscal year.—Value of United States plant, $3,500. Including $38.56 outstanding liabilities, the expenses of the year were $551.50.

During the year a project has been submitted and approved for work under the new appropriations, and contract for the dredging entered into with J. H. Fenner of Jersey City, N. J., at 16.5 cents per cubic yard, under date of 6th February, approved by the Chief of Engineers February 25, work (together with that at Hyannis) to be commenced by 1st May and completed 1st October, 1893. The contractor has been delayed in commencing work so that no dredging has as yet been actually done.

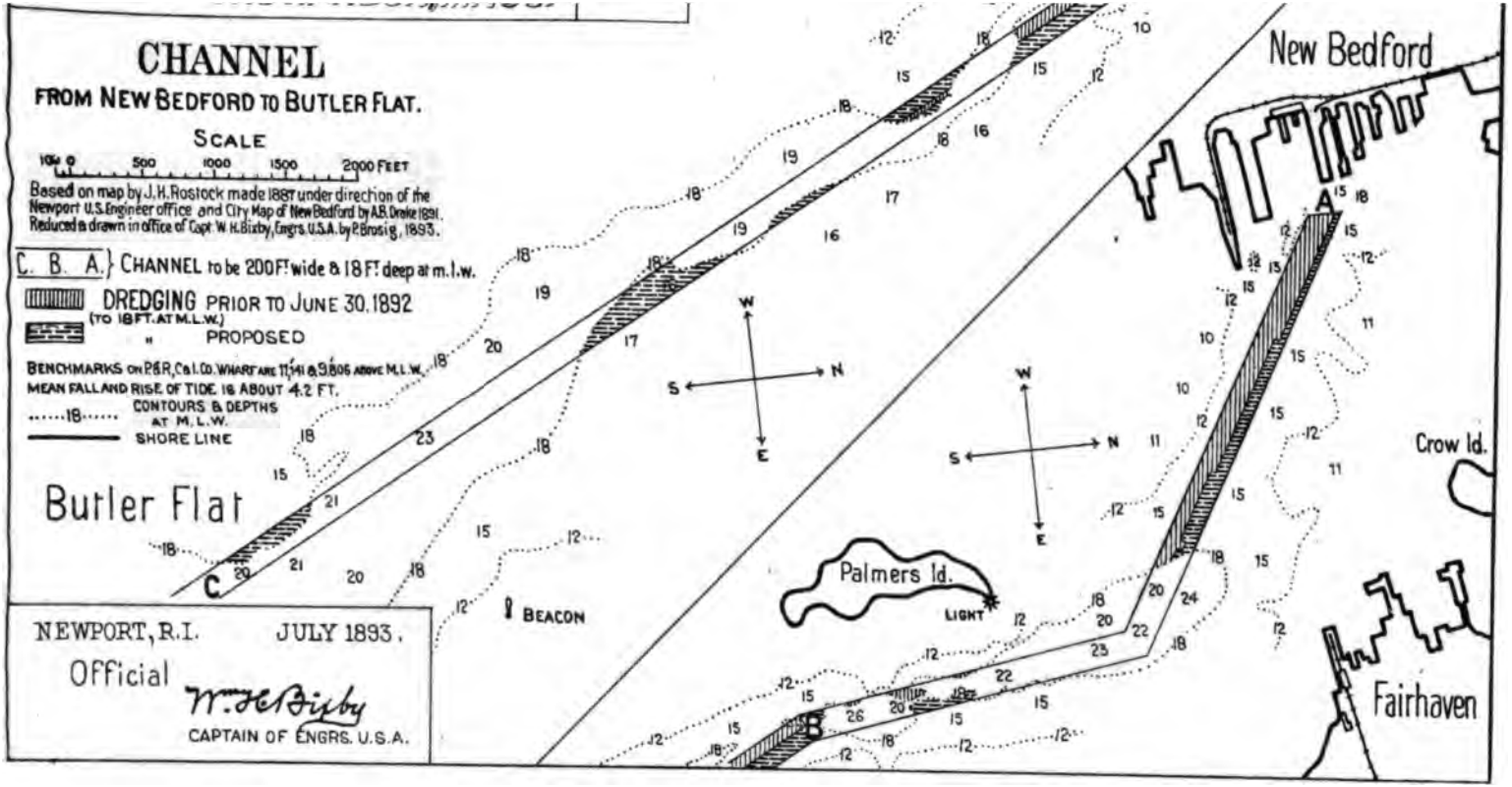
This work was in the local charge of Mr. Edward Parrish, as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the remaining half of the channel 200 feet wide and 18 feet deep, extending from the 11-foot bank to the vicinity of the wharves at New Bedford, and the removal of a few shoal spots between the 11-foot bank and the Butler Flats, the southern end of the projected channel.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand and the funds asked for to continuing the work of dredging in the new channel.


BEDFORD HARBOR, MASS.
SCALE
1000 0 5000 10000 FEET
Compiled from U.S.C.S. Chart and surveys made under direction of the Newport U.S. Engineer office. Drawn in office of Captain W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig 1893.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.2 FT.
18 CONTOURS & DEPTHS (FT.) AT M.L.W.
CHANNEL, PROPOSED (200 FT. WIDTH & 18 FT. DEPTH.)
Official
W.H. Bixby
Captain of Engrs. U.S.A
Sheet No. 1.
N
W
E
S
New Bedford
Fairhaven
Popes Id.
Fish Id.
Crow Id.
R.R.
LIGHT
Palmers Id.
FORT PT.
BEACON
Egg Id.
LITTLE BAY
SCONTICUT NECK
NASKETUCKET BAY
CLARKS COVE
CLARKS POINT
BUTLERS FLAT
CLARKS PT. LIGHT
MOSHERS PT.
Buzzards Bay
SCONTICUT PT.
Vicinity of New Bedford, Mass.
Miles
10 5 0 10
New Bedford
Fairhaven
Wareham
NARRAGANSETT BAY
Newport
Westport
SEAKONNET POINT
PT. JUDITH
BUZZARDS BAY
ELIZABETH IS.
Woods Hall
VINEYARD SOUND
Marthas Vineyard.
NANTUCKET SOUND
Atlantic Ocean

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CHANNEL
FROM NEW BEDFORD TO BUTLER FLAT.
SCALE
0 500 1000 1500 2000 FEET
Based on map by J. H. Rostock made 1887 under direction of the Newport U.S. Engineer office and City Map of New Bedford by A.B. Drake 1891. Reduced & drawn in office of Capt. W. H. Bixby, Engrs. U.S.A. by P. Brosig, 1893.
C. B. A. } CHANNEL to be 200 Ft. wide & 18 Ft. deep at m.l.w.
DREDGING PRIOR TO JUNE 30. 1892 (TO 18 FT. AT M.L.W.)
" PROPOSED
BENCHMARKS ON P&R, Co's I. CO. WHARF ARE 11.141 & 9.806 ABOVE M.L.W.
MEAN FALL AND RISE OF TIDE IS ABOUT 4.2 FT.
18 CONTOURS & DEPTHS AT M.L.W.
SHORE LINE
Butler Flat
NEWPORT, R.I. JULY 1893.
Official
W. H. Bixby
CAPTAIN OF ENGRS. U.S.A.
BEACON
Palmers Id.
LIGHT
New Bedford
Crow Id.
Fairhaven
A
B
C
W
S
N
E

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Bedford Harbor is in the New Bedford collection district, which is in a port
r. The amount of revenue collected in the last calender year was $86,589.84.
arest light-houses are Clark Point Light and the lights in New Bedford
. The nearest fortification is fort Clark Point, Mass.

Money statement.

1892, balance unexpended		$462.86
t appropriated by act approved July 13, 1892		7,500.00
		7,962.86
), 1893, amount expended during fiscal year		726.73
1893, balance unexpended		7,236.13
1893, outstanding liabilities	$38.56	
1893, amount covered by uncompleted contracts	5,000.00	
		5,038.56
1893, balance available		2,197.57
ınt (estimated) required for completion of existing project		7,500.00
ınt that can be profitably expended in fiscal year ending June 30, 1895		7,500.00

itted in compliance with requirements of sections 2 of river and
bor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

t of proposals opened January 10, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for dredging in the harbor at New Bedford, Mass.

[Quantity required, about $5,000 worth of work.]

Bidders.	Price bid per cubic yard.		Remarks.
	On this work alone.	In connection with other work.	
	Cents.	*Cents.*	
H. Fenner, Jersey City	.15	.16½	Combination bid includes work at Hyannis.
jah Brainard, New York	.25		

ract awarded to J. H. Fenner at 16½ cents.

COMMERCIAL STATISTICS.

commerce arriving and leaving New Bedford Harbor by water during the cal-
rear ending December 31, 1892, is estimated as follows (based mainly upon re-
ceived from Mr. James Taylor, collector of customs, New Bedford, Mass.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
ters, etc	$150,000	$220,000	$370,000	92,000
k and products		8,200	8,200	70
es and truck		93,100	93,100	930
d forage		535,000	535,000	23,000
	2,000		2,000	2
id products		2,851,000	2,851,000	14,200
res		20,700	20,700	2,000
nd products	15,000	400,000	415,000	30,400
rals, and products	1,200	1,600,000	1,601,200	400,300
erchandise	8,419,000	2,800,000	11,210,000	112,000
		1,552,000	1,552,000	52,000
l	8,578,200	10,080,000	18,658,200	727,000

Gain over last year about 100,000 tons, or $2,500,000. Transportation lines established during the year, none.

The passage of vessels through this water way is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	700	8	560
Freight mainly	450	17	1,000
Passenger mainly	500	8	60
Tugs	650	8	50
Pleasure boats	250		
Sail:			
Freight	1,700	13	800
Fishing boats	500	5	10
Pleasure boats, large	400		
Pleasure boats, small	1,000		

C 7.

IMPROVEMENT OF WESTPORT HARBOR, MASSACHUSETTS.

Westport Harbor is an estuary on the coast of Massachusetts, lying between Narragansett Bay, Rhode Island, and Buzzards Bay, Massachusetts. The site of the work is on Horse Neck Point (the north side of the entrance to the harbor).

Original condition.—Before the commencement of the improvement the site of the present work was a point of sand forming the northern and eastern boundary of the entrance to the harbor and subject to erosion by the sea and tides.

In 1886 $1,000 was appropriated for the special protection of Horse Neck Point, on the north side of the harbor entrance. This work was completed in 1887 by the construction of a timber jetty filled with stone.

At the adoption of the present project Horse Neck Point was still gradually wearing away and the adjacent parts of the channel and harbor were shoaling.

Plan of improvement.—The present approved project, that of 1888, provides: For the improvement of the channel from the Atlantic Ocean up the west branch to Adamsville, up the east branch to Westport Point, so as to secure and maintain a channel depth of 7 feet at low water over its entire length, by dredging on the "Lions Tongue" Shoal if necessary; and for the protection of Horse Neck Point (the eastern headland of the entrance), so as to prevent the erosion of this point and the shoaling of the adjacent parts of the channel and harbor; all at a total cost estimated in 1888 at $2,000.

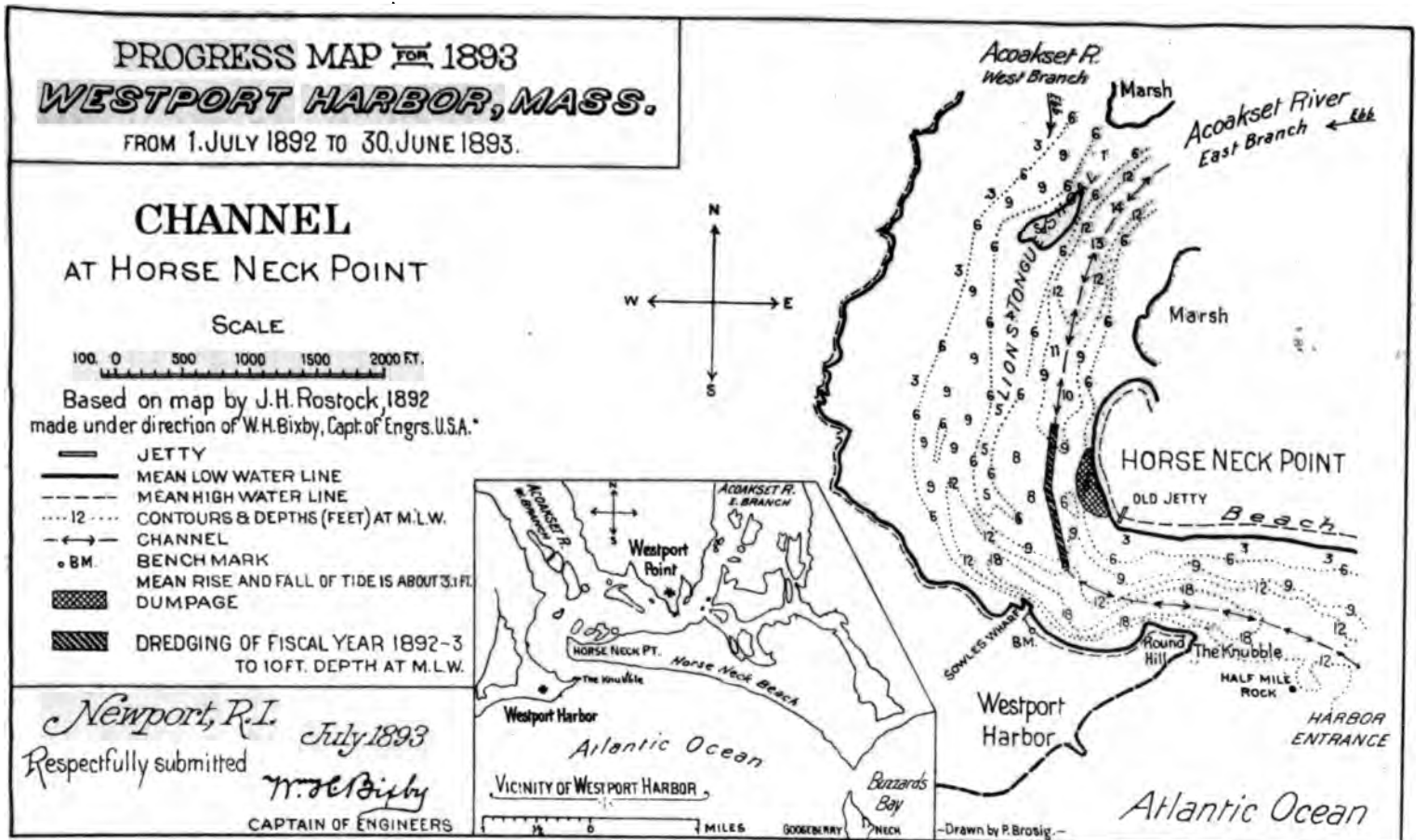
A description of the work may be found at p. 645, Annual Report of the Chief of Engineers for 1889.

Appropriations.—Upon the present projects appropriations have been made as follows: In 1890, $1,000; 1892, $1,000; total up to June 30, 1893, $2,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $0.00 outstanding liabilities) up to June 30, 1892, was $662.19, by which the jetty at Horse Neck Point has been rebuilt to 150 feet length.

Operations during the past fiscal year.—Value of United States plant, $30. Including $287.82 outstanding liabilities, the expenses of the year were $1,275.78.

During the year a project has been submitted and approved for work under the new appropriation, allowing all work to be done by


PROGRESS MAP FOR 1893
WESTPORT HARBOR, MASS.
FROM 1. JULY 1892 TO 30. JUNE 1893.
CHANNEL
AT HORSE NECK POINT
SCALE
100. 0 500 1000 1500 2000 FT.
Based on map by J.H. Rostock, 1892
made under direction of W.H. Bixby, Capt. of Engrs. U.S.A.
JETTY
MEAN LOW WATER LINE
MEAN HIGH WATER LINE
12 CONTOURS & DEPTHS (FEET) AT M.L.W.
CHANNEL
BM. BENCH MARK
MEAN RISE AND FALL OF TIDE IS ABOUT 3.1 FT.
DUMPAGE
DREDGING OF FISCAL YEAR 1892-3
TO 10 FT. DEPTH AT M.L.W.
Newport, R.I. July 1893
Respectfully submitted
W.H. Bixby
CAPTAIN OF ENGINEERS
N
W
E
S
Acoakset R.
West Branch
Marsh
Acoakset River
East Branch
Ebb
LION'S TONGUE
Marsh
HORSE NECK POINT
OLD JETTY
Beach
SOWLES WHARF
B.M.
Round Hill
The Knubble
HALF MILE ROCK
Westport Harbor
HARBOR ENTRANCE
Atlantic Ocean
Acoakset R. W. Branch
Acoakset R. E. Branch
Westport Point
HORSE NECK PT.
Horse Neck Beach
The Knubble
Westport Harbor
Atlantic Ocean
VICINITY OF WESTPORT HARBOR
½ 0 1 MILES
GOOSEBERRY NECK
Buzzards Bay
Drawn by P. Brosig.

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red labor and the use of the Government plant. A minor survey as been made to serve as a basis for the season's work. The dredg- g (commenced May 20, stopped May 31) has been completed as far as nds would allow, and 6,500 cubic yards of hard sand have been re- oved from 1,086 feet length and 33 feet width of cutting and to a pth of at least 10 feet at low water, completing a single cut entirely ross the shoal at the mouth of the east branch of Westport River. This work was in the local charge of Mr. J. H. Rostock as assistant gineer.

Work required to complete the existing project.—No further fieldwork is nsidered necessary.

Operations contemplated for the fiscal year ending June 30, 1894.—It is oposed to apply the balance on hand to the completion of the project ove described.

Westport Harbor is in the collection district of New Bedford, which is a port of try. The amount of revenue collected at New Bedford during the last calendar ar was $86,589.84. The nearest light-house is Seaconnet Light. The nearest for- ication is fort at Clark Point, New Bedford, Mass.

Money statement.

ly 1, 1892, balance unexpended	$337.81
nount appropriated by act approved July 13, 1892	1,000.00
	1,337.81
ne 30, 1893, amount expended during fiscal year	987.96
ly 1, 1893, balance unexpended	349.85
ly 1, 1893, outstanding liabilities	287.82
ly 1, 1893, balance available	62.03

COMMERCIAL STATISTICS.

The commerce arriving and leaving Westport Harbor by water during the calen- ar year ending December 31, 1892, is estimated as follows (based mainly upon reports eceived from Mr. Abraham Manchester, Adamsville, R. I.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
ish, oysters, etc	$500		$500	8
ive stock and products	60,000		60,000	300
egetables and truck	4,600		4,600	200
rain and forage		$14,000	44,000	2,400
ertilizers		7,500	7,500	200
umber and products		1,000	1,000	
al, minerals, and products		4,200	4,200	600
achinery and hardware		6,000	6,000	40
neral merchandise		66,000	66,000	470
ndries		500	500	20
Total	65,100	129,200	194,000	4,200

rain over last year, none known. Transportation lines established during the ar, none.

The passage of vessels through this water way is estimated as follows (each trance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
l:		*Feet.*	*Tons.*
Freight	120	6	50
Fishing boats	300		
Pleasure boats, large	250		
Pleasure boats, small	600		

C 8.

IMPROVEMENT OF CANAPITSIT CHANNEL, MASSACHUSETTS.

This waterway lies about 20 miles south of New Bedford, running between the islands of Cuttyhunk and Nashawena, and connecting the waters of Vineyard Sound and Buzzards Bay.

The object of the improvement is to make this channel safe for the use of light-draft sailboats, and also especially of the surf boats belonging to the life-saving station of this dangerous locality.

Original condition.—Before improvement the sand shoals, and especially the numerous bowlders, made this passage specially dangerous to the life-saving station boats and other shallow-draft row and sail boats.

Plan of improvement.—The present approved project, that of 1891, provides for the widening and deepening of the present channel from Vineyard Sound to the ocean between the islands of Nashawena and Cuttyhunk, Massachusetts, so as to secure a depth of 6 feet at low water with a least width of 250 feet over its entire length, all at a total cost estimated in 1891 at $4,800.

A description of the work may be found at p. 645, Annual Report of the Chief of Engineers for 1892, and a plan of the same in House Ex. Doc. No. 59, of the Fifty-second Congress, first session.

Appropriations.—Upon the present project only one appropriation has been made, that of 1892 for $4,800.

Amount expended and results to June 30, 1892.—Nothing had been done prior to June 30, 1892, for want of funds.

Operations during the past fiscal year.—Value of United States plant, $500. Including $2,248.32 outstanding liabilities, the expenses of the year were $3,787.86.

During the year a project has been submitted and approved for work under the new appropriations, bids to be asked for the dredging, modified later to allow of work by hired labor and the use of the Government plant, no bids having been received from anyone even after extended advertisement.

Work in the field was commenced on June 3 by the Government plant (1 dredge, 1 tug, and 2 scows), and between that date and the 29th about 1,155 tons of large bowlders were broken up and blasted in such way as to clear an area of about 1,000 feet length and 300 feet breadth to about 3 feet depth at low water, and also about 1,117 cubic yards of hard sand, 944 cubic yards of cobblestone and gravel, and 1,223 cubic yards of large bowlders were removed from 1,214 feet length and 33 feet width of cutting, so as to complete a channelway of at least 66 feet, and at least 5 feet depth at low water entirely through this waterway from Buzzards Bay to Vineyard Sound. Work was temporarily stopped because of an accident to the dredge bucket, combined with the near exhaustion of available funds.

This work has been in the local charge of Mr. J. H. Rostock as assistant engineer and Mr. John Dill as superintendent.

Work required to complete the existing project.—The work yet to be done is to deepen the 66-feet-width channel by about 1 foot and the remaining 83 to 283 feet width of channel by about 2 feet.

The original estimates of Maj. Livermore (p. 647, Annual Report of 1892) placed the cost of this work at $4,800; but this estimate was based upon the low water of the time of the examination (a foot higher than ordinary) and upon field reports from persons not sufficiently ex-

GRESS MAP FOR 1893
TSIT CHANNEL, MASS.

FROM 1 JULY 1892 TO 30 JUNE 1893.

CANAPITSIT CHANNEL
between
CUTTYHUNK & NASHAWENA ISLANDS
connecting
BUZZARDS BAY WITH VINEYARD SOUND

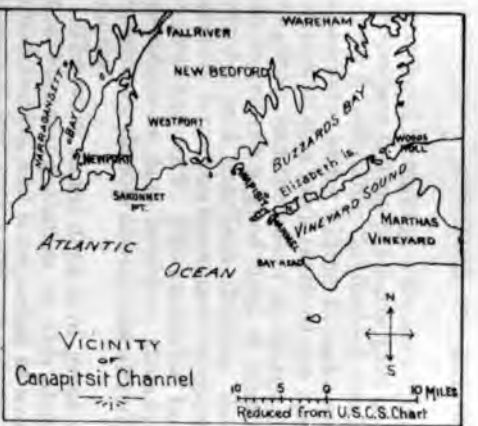
SCALE
100 0 500 1000 1500 FT.

Original map made by J.H. Rostock 1891
Reduced & drawn in office of Captain W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig, 1893.

— WORK OF FISCAL YEAR 1892-3. —
BLASTING TO 3 FT. DEPTH AT M.L.W.
DREDGING TO 5 FT.
DUMPAGE OF FIRST CUT
UNCOMPLETED AREA
SHORE LINE AT M.L.W.
12 CONTOURS & DEPTHS (FEET) AT M.L.W.
B.M. BENCHMARKS No 1 = 15.56, No 2 = 10.56 ABOVE M.L.W.
ROCKS
MEAN RISE & FALL OF TIDE IS ABOUT 3.6 FT.

Newport, R.I. July 1893
Respectfully submitted
W.H. Bixby
CAPTAIN OF ENGINEERS

DUMPAGE GROUND
Buzzards Bay
B.M. No 1
B.M. No 2
CANAPITSIT CHANNEL
Cuttyhunk Island
Nashawena Island
Vineyard Sound
Atlantic Ocean
DUMPAGE GROUND



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ed in making estimates upon work of just this nature. Special tion during the early part of the past year having indicated diffi- n obtaining the desired results with the funds in hand, and no ctor being willing to make any bid at all upon the work, the exe- of this work received the special attention of both the assistant er and the officer in charge. The nature of the work was such equire a good deal of blasting and such as to heavily task a and excellent dredge, the materials to be excavated being large bowlders and the channel entrance being exposed to ocean and surf. The amount of bowlders blasted and of sand, gravel, stone, and bowlders already removed with the funds already see details above) has already been in excess of the original esti-

work so far done is of great value to the service of the boats of e-saving station at this place; bids fair to be permanent in its esults, and is regarded as worthy of being continued up to the (6 feet) and width (about 200 feet inside and 300 feet outside) of ginal project. Such extension, however, will cost about $500 for xpenses, about $1,500 for use of plant (including hire, or storage pair and cost of moving to and from work), and about $3,000 for field work; making a total of $5,000 in addition to the small e still remaining on hand.

ations contemplated for the fiscal year ending June 30, 1894.—It is ed to apply the balance of funds and future appropriations to nly deepening the full-width channel by the removal of the rocks ch the water is shoalest.

Money statement.

appropriated by act approved July 13, 1892	$4,800.00
, 1893, amount expended during fiscal year	1,539.54
1893, balance unexpended	3,260.46
1893, outstanding liabilities	2,248.32
1893, balance available	1,012.14
nt (estimated) required for completion of existing project	5,000.00
nt that can be profitably expended in fiscal year ending June 30, 1895	5,000.00

itted in compliance with requirements of sections 2 of river and bor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

ommerce arriving and leaving Cuttyhunk, Mass., by water during the calen- r ending December 31, 1892, is estimated as follows (based mainly upon re- eived from Mr. D. P. Bosworth, keeper life-saving station, Cuttyhunk, Mass.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
ters, etc	$8,100		$8,100	180
and products	610	$300	910	4
s and truck	70		70	3
forage		560	560	16
		1,500	1,500	1
res		540	540	2
nd products		500	500	40
rals, and products	480	350	830	350
erchandise		12,700	12,700	20
	200	200	400	70
l	9,500	16,700	26,200	700

Gain over last year, none known. Transportation lines established during the year, none.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger*	144	9	80
Passenger mainly	5	9	60
Pleasure boats	100	4	25
Sail:			
Fishing boats	1,000	3	6
Pleasure boats, small	300	4	15

* Carries mail daily in summer, weekly in winter.

C 9.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

This river rises in Norfolk County, Mass., and empties into Mount Hope Bay, a part of Narragansett Bay. It is about 44 miles in length.

The object of the improvement is to deepen and widen the channel so that vessels of 11 feet draft can at high water go up to the city of Taunton, which for its extensive manufactures requires large quantities of coal, iron, clay, moldings, sand, and other heavy articles. The rise and fall of the tide before improvement was 5¼ feet at Dighton and 3.4 feet at Taunton.

Original condition.—In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton its depth was not, in places, more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

From 1870 to 1879 $63,000 was appropriated to secure a depth of 9 feet at high water, up to the head of navigation. This work was completed in 1879 (see p. 375 Annual Report of 1880).

At the adoption of the present project, the channel was limited to 9 feet at high water and was too narrow, and too much obstructed by bowlders for easy navigation by the craft making use of it.

Plan of improvement.—The present approved project, that of 1880, as modified in 1888, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal; thence 11 feet depth with 80 feet width up to the Ship Yard; thence 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1888 at $108,000.

A plan of the works may be found at p. 606, Annual Report of the Chief of Engineers for 1884; and a later more detailed plan in House Ex. Doc., No. 86, of the Fiftieth Congress, first session; and further information at p. 373 of the Annual Report of 1880, and p. 519 of 1888.

Appropriations.—Upon the present project appropriations have been made as follows: 1880, $17,500; 1881, $25,000; 1882, $25,000; 1884, $26,500; 1890, $7,000; 1892, $7,000. Total up to June 30, 1893, $108,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $4.30 outstanding liabilities) up to June 30, 1892, was $100,981.28, by which a large part of the pro-

posed work had been done; especially at the places most complained of by the vessels using this river.

Operations during the past fiscal year.—Value of United States plant, $1,000. Including $51.01 outstanding liabilities, the expenses of the year were $7,014.95.

During the past fiscal year a project has been submitted and approved for work under the new appropriations; allowing all work to be done by hired labor and the use of the Government plant.

Active field work was resumed on the 15th September, and 1,830 cubic yards of dredged material and 47 tons of bowlders had been removed from Briggs Shoal, completing work at that shoal; 325 cubic yards of dredged material and 101 tons of bowlders had been removed from the Needles, leaving some further work of blasting and hoisting, to get full width; and 1,535 cubic yards of dredged material and about 26 tons of bowlders were removed from the reach below Three Mile River, completing all work at this shoal; 415 cubic yards of sand, etc., were dredged in the reach opposite Three Mile River, leaving some further work of dredging to get full width; and 945 cubic yards of sand, etc., were dredged at Burts Turn, completing all work at this place.

Work of dredging stopped on the 29th November. A minor survey of the river has been since made from Weir to Dighton to determine the condition of the past work and serve as a basis for future operations.

This work was in local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—There remain to complete the existing project the widening and deepening of the channel at a few points and the removal of a small amount of ledge rock. The cost of this work is estimated at $17,000 in addition to the funds on hand at the end of the year.

The original project by Gen. Warren in 1880 (see p. 373 and 376, Annual Report 1880) estimated $94,000 for a channel varying from 11 to 12 feet depth and from 60 to 100 feet width (according to circumstances) over the entire river. From 1880 to 1884, inclusive, the entire amount, $94,000, was appropriated for this work; but without quite completing it to the satisfaction of the engineer officer then in charge (Colonel Elliot) or of that of the shipping interests.

Accordingly a new survey was ordered by Congress in 1886 and made in 1887 (see p. 518–519, Annual Report 1888); as a result of which further work was found to be necessary in the upper third of the river, between Berkley Bridge and Taunton, the cost of this work being estimated by the engineer officer then in charge (Maj. Livermore) at $14,000, thus raising the original estimates from $94,000 to $108,000. This survey of 1887 assumed that the necessary or desired widths and depths had been obtained over the lower half of the river, and the extent of the survey was therefore limited to the upper half of the river, that above Berkley Bridge, and the resulting $14,000 estimates of 1888 provided only for work to be done above Pioneer Rock (about half a mile above Berkley Bridge). The $14,000 thus estimated for, to be appropriated at once in one sum, was finally appropriated in two portions in 1890 and 1892; and this amount was in due time spent on the portion of the river covered by the 1887 survey and the 1888 recommendations. The work, however, was of such difficult nature and the biannual appropriation so small that no contractor was willing to make any bid at all upon it, although such bids were invited by advertisements of 1890 and 1891. In the subsequent prosecution of this work by hired labor and

the Government plant, it was found, firstly, that prior labor under contract had not quite thoroughly done much of the more difficult parts of the under-water work, so that considerable of the river had to be gone over a second time by the United States force; and, secondly, that the work itself was of a more expensive nature than anticipated at the time of the 1888 estimates. As a result the final work of 1892–'93 has been thoroughly done; but this thoroughness (and the division of work into two parts, according to appropriations) has cost about $1.50 per cubic yard, against the $1 per yard of the estimates; and, consequently, to-day another $7,000 (in addition to the $14,000 already spent) is now needed to complete the work estimated at $14,000 in 1885. Much of this extra cost might, however, have been avoided had the $14,000 been appropriated in one year, as expected at the time of the estimates, instead of being so appropriated as to force work to be spread over three years.

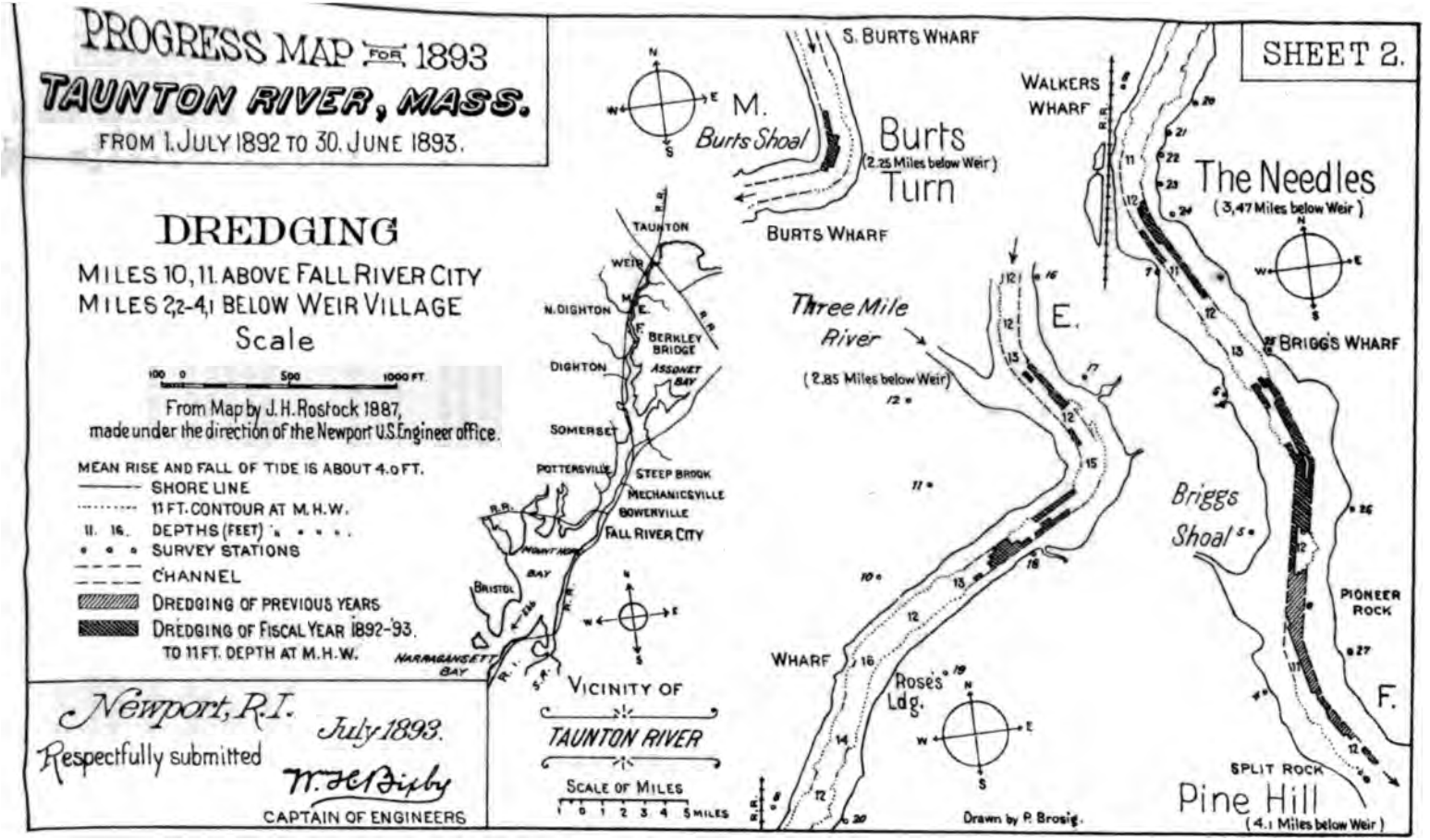
Detailed surveys of the past year (1892) show work as follows to be still necessary above Pioneer Rock, to complete the present approved (1880) project:

At Blakes Wharf (about 1.5 mile from Weir Bridge) a short length of channel needs widening and the removal of a few bowlders, at an estimated cost of about	$1,000
At Pond Rock Shoal a short length of channel needs a little widening and the removal of a few bowlders, at an estimated cost of about	500
Just below North Dighton Wharf a short length of a channel needs widening and the removal of a few bowlders, at an estimated cost of about	830
Just below Three Mile River a short length of channel needs widening, at an estimated cost of about	1,000
At the Needles a considerable length of channel needs widening and the removal of a few bowlders, at an estimated cost of about	2,500
Total for field work	5,830
Superintendence and contingencies, 20 per cent	1,170
Grand total above Pioneer Rock	7,000

Regarding the portion of the river *below* Pioneer Rock, it was apparently assumed in 1887 that the channel of this portion of the river was then nearly enough completed; and so the new survey was not extended below Berkley Bridge, nor any estimates then submitted for work below Pioneer Rock. Portions of the lower part of the river were resurveyed in 1881, but no complete surveys of the portion from Berkley Bridge down to Dighton appear to have been made since 1874—that is, not before the 1892 survey. This 1892 survey developed the fact that during the past ten years, while work has been under progress in the upper third of the river, the middle third of the river has filled up at a few places and the channels of the existing approved project are no longer continuous. This reshoaling, however, is not of a nature to specially indicate continuous reshoaling, being apparently the result of temporary causes, such as the improvement of the upper river, special overflows or breaks in the banks, etc., and consequently it is thought proper that the shoals should be again (and finally) removed under the present approved project. The 1892 survey shows the following work as still necessary *below* Pioneer Rock, in order to complete the present approved (1880) project:

Just above Berkley Bridge about 1,800 feet length of channel needs about a foot of deepening, at an estimated cost of about	$2,200
Just above Church's Wharf about 600 feet length of the 12-feet-depth channel needs about 60 feet of widening, at an estimated cost of about	2,200
Just below Wikamount about 300 feet length of the 12-feet-depth channel needs about 60 feet of widening, at an estimated cost of about	800
Just above Peters Point about 600 feet length of the 12-feet-depth channel needs from 30 to 60 feet of widening, at an estimated cost of about	1,400

NATICK, MASS.


PROGRESS MAP FOR 1893
TAUNTON RIVER, MASS.
FROM 1. JULY 1892 TO 30. JUNE 1893.
SHEET 2.
DREDGING
MILES 10, 11. ABOVE FALL RIVER CITY
MILES 2,2-4,1 BELOW WEIR VILLAGE
Scale
100 0 500 1000 FT.
From Map by J. H. Rostock 1887,
made under the direction of the Newport U.S. Engineer office.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.0 FT.
SHORE LINE
11 FT. CONTOUR AT M. H. W.
DEPTHS (FEET)
SURVEY STATIONS
CHANNEL
DREDGING OF PREVIOUS YEARS
DREDGING OF FISCAL YEAR 1892-'93.
TO 11 FT. DEPTH AT M. H. W.
Newport, R.I.
July 1893.
Respectfully submitted
W. H. Bixby
CAPTAIN OF ENGINEERS
VICINITY OF
TAUNTON RIVER
SCALE OF MILES
1 0 1 2 3 4 5 MILES
S. BURTS WHARF
M.
Burts Shoal
Burts
(2.25 Miles below Weir)
Turn
BURTS WHARF
WALKERS WHARF
The Needles
(3,47 Miles below Weir)
TAUNTON
WEIR
N. DIGHTON
BERKLEY BRIDGE
DIGHTON
ASSONET BAY
SOMERSET
POTTERSVILLE
STEEP BROOK
MECHANICSVILLE
BOWERVILLE
FALL RIVER CITY
MOUNT HOPE BAY
BRISTOL
NARRAGANSETT BAY
Three Mile River
(2.85 Miles below Weir)
E.
BRIGGS WHARF
Briggs Shoal
PIONEER ROCK
F.
WHARF
Roses Ldg.
SPLIT ROCK
Pine Hill
(4.1 Miles below Weir)
Drawn by P. Brosig.

Eng 93

Opposite Peters Point a small amount of ledge rock (that referred to in the 1888 report) still remains to be taken out, at an estimated cost of about...	$350
Just above the Dighton Wharves about 800 feet length of the 12-feet-depth channel needs about a foot of deepening, at an estimated cost of about....	1,400
Total for field work.....	8,350
Superintendence and contingencies, 20 per cent.....	1,650
Grand total below Pioneer Rock	10,000

If the original and existing approved project of 1880 for this river is to be carried to completion (the changes of 1888 being merely the asking of more funds for special items of the most needed work on the upper third of the river), it will be necessary to change the existing estimates ($94,000 of 1880, raised to $108,000 in 1888) by adding $7,000 for the completion of work on the upper third of the river (that specially considered in 1888) and adding $10,000 for the completion of work on the middle third of the river (part of the original and continued project); making the total cost of the whole work $125,000, instead of $108,000 as heretofore reported. This river is still regarded as worthy of the originally-recommended improvement, and therefore of having the work done even at the increased cost.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand to the completion of the existing project for the improvement of the river.

Taunton River is in the Fall River collection district. Fall River is the nearest port of entry. The amount of revenue collected at Fall River in the last calendar year was $217,256.77. The nearest light-house is the Borden Flat light-house. The nearest fortification is Fort Adams, Newport Harbor, Rhode Island.

Money statement.

July 1, 1892, balance unexpended	$23.02
Amount appropriated by act approved July 13, 1892	7,000.00
	7,023.02
June 30, 1893, amount expended during fiscal year.....	6,968.24
July 1, 1893, balance unexpended	54.78
July 1, 1893, outstanding liabilities	51.01
July 1, 1893, balance available	3.77
Amount (estimated) required for completion of existing project.....	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	17,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. EDWARD PARRISH, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 1, 1893.

SIR: I have the honor to submit the following report of operations on Taunton River, Massachusetts, during the fiscal year ending June 30, 1893.

The general project of 1880 for the improvement of this river to certain widths and depths, at an estimated cost of $94,000, was supplemented in 1887 by a special survey and report upon the amount of work still to be done. (See Annual Report of Chief of Engineers for 1888, p. 517.)

In this 1887 report, it was stated that some further widening of the channel was needed at the following points above Berkley Bridge:

From a point just below "Pioneer Rock" up the river to the mouth of Three Mile River; at "Burts Turn;" at "Pond Rocks Shoal," and for a short distance below the bridge at Weir.

In addition to this, the removal of a small amount of ledge rock was contemplated below Peter Point near the lower end of the improved portion of the river.

The work at the above points was estimated to cost over $14,000, making the total cost of the improvement, to date, $108,000.

The river and harbor act of July 23, 1892, appropriated $7,000 for the completion of the project.

Early in August, 1892, the preparation of the Government plant for work was commenced, and the necessary annual repairs were made to the dredge *Rhode Island*, dump scows, water boat, and launch *Gen. Warren*.

On September 15, the dredge was placed in position on Briggs Shoal where the last work had previously terminated, and the widening and deepening wherever needed was carried up the river at the following places:

Between Briggs Shoal and the "Needles" 1,830 cubic yards of sand, gravel, clay, cobblestones and small bowlders and 47 tons of large bowlders were removed, completing the channel from the "Needles" to and through "Briggs Shoal" to its full width of 80 feet, and depth of 11 feet, at mean high water.

In the Needles 325 cubic yards of hard clay, cobblestones, and small bowlders, and 100.5 tons of large bowlders were removed from parts of three cuts, 20 feet wide, aggregating 800 feet in length. The dredging here was very difficult, not only by reason of the exceedingly hard character of the bottom, but from the fact that in many places less than 1 foot needed to be removed to secure the required depth.

Probably the most effective work in the Needles and also through Briggs Shoal was the removal of a few large bowlders on which vessels frequently struck. This was accomplished by the United States lighter *Frooman*, which on the 26th of October was placed on the work, equipped with a diver and outfit for blasting and removing from the channel bowlders which had proved too large for the dredge to handle.

The channel through the "Needles" has now a minimum width of 70 feet, with a depth of 11 feet at mean high water, and this minimum is for only a short distance near the upper end.

Between the upper end of the Needles and the Point, just below Three Mile River, 1,535 cubic yards of sand, gravel, clay, and small bowlders and 20 tons of large bowlders were removed, completing this portion of the channel to its full width of 80 feet and depth of 11 feet.

Opposite to and just below the mouth of Three Mile River 415 cubic yards of a clayey quicksand were removed. Progress in this material was slow, from the difficulty of keeping the very fine sand from running out of the scows, and from the firm grip with which it held the spuds of the dredge, interfering greatly with her movements.

Before completing the work in this portion of the river it became apparent that the funds would not be sufficient to complete all the contemplated work, and so the dredge was then moved from the mouth of Three Mile River and set to work at "Burts Turn," a point where the channel had narrowed to such an extent as to make it difficult for tows to pass. At this point 945 cubic yards of sand were removed, and the channel, 100 feet wide and 11 feet deep at mean high water, was completed.

Work was suspended November 29, 1892, leaving only sufficient funds for the laying up of the plant for the winter.

Of the proposed work the following remains incomplete:

A slight widening of the channel at Pond Rocks Shoal by the removal of a few bowlders and perhaps a small amount of dredging.

The completion of the dredging just below Three Mile River.

The completion of the work in the Needles and the removal of a small amount of ledge rock just below Peter Point.

The amount of material to be removed from these localities is small, and they are from three-quarters of a mile to 2 miles apart, so that the following estimate * * * of completing the work is based on the time * * * of a suitable dredging plant, including dredges, scows, and tugboat, * * * and of an outfit consisting of vessel equipped with suitable diving, drilling, blasting, and hoisting appliances. * * *

At Pond Rocks Shoal.—Three days' drilling, blasting, etc.; two days' dredging.

Near the mouth of Three Mile River.—Eight days' dredging.

In the Needles.—Fifteen days' dredging; fifteen days' drilling, blasting, etc.

Ledge below Peter Point.—Six days' drilling and blasting.

Sundries.—Six days going to and leaving the work of both the dredging and rock plant, superintendence, and office expenses.

Nearly all the work in Taunton River is very hard in character, and as no bids could be obtained for the work after the usual advertisement under the appropriation for 1890 it became necessary to do it with Government plant, which necessitated considerable outlay in preparation for this special work; and as the total amount of $14,000 asked for under the last special report was appropriated in two sums of $7,000 each, it further required the preparation, annual repairing, and the laying up of the

C 10.

IMPROVEMENT OF PAWTUCKET RIVER, RHODE ISLAND.

The navigable part of the Pawtucket (or Seekonk) River, an arm of Providence River, extends from Providence to Pawtucket, a city which in 1885 had a population of about 23,000 and extensive manufactures, depending largely on water transportation. The mean rise and fall of the tide is about 5 feet.

Original condition.—Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water.

Between 1867 and 1882 $52,000 was appropriated to dredge the channel to 75 feet width and 7 feet depth at low water. This work was completed in 1876.

At the adoption of the present project the channel was narrow and only about 7 feet deep.

Plan of improvement.—The present approved project, that of 1883, provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth at Providence up to opposite Grant & Co.'s wharf, at Pawtucket, and thence 12 feet depth with 40 feet width through a stone ledge for a short distance towards Pawtucket Bridge; all at a total cost estimated in 1883 at $382,500.

A plan of the works may be found at page 608, Annual Report of the Chief of Engineers for 1884.

Appropriations.—Upon the present project appropriations have been made as follows: 1884, $50,000; 1886, $30,000; 1888, $35,000; 1890, $30,000; 1892, $35,000. Total up to June 30, 1893, $180,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $482.20 outstanding liabilities) up to June 30, 1892, was $144,777.32, by which the shoalest places had been improved and about nine-tenths of the needed work done, securing a channel of about 12 feet depth with from 40 to 100 feet width (the greater portion being 100 feet wide) up to above the lower wharves of the city of Pawtucket.

Operations during the past fiscal year.—Value of United States plant, $15,000. Including $28.34 outstanding liabilities, the expenses of the year were $802.79.

During the year: A project has been submitted and approved for work under the new appropriation; and contract for dredging entered into with R. G. Packard of New York City, at 42 cents per cubic yard, under date of February 14, approved by the Chief of Engineers February 25; work (together with that of Providence River (Narragansett Bay) and Green Jacket Shoal, Rhode Island,) to be commenced first of May 1893, and to be completed the first of April, 1894. A minor survey has been made to serve as basis for the coming season's work. No dredging has yet been actually commenced, the contractor using his plant and force first on the other parts of his contract.

This work was in the local charge of Mr. Edward Parrish, as assistant engineer.

Work required to complete the existing project.—The work yet to be done is to excavate the channel to its full width of 100 feet from Bass Rock to Dunnell's Wharf, and from the Gas Company's Wharf to Grant & Co.'s Wharf and to deepen the channel through the ledge to the same depth with a width of 40 feet.

Operations contemplated for the fiscal year ending June 30, 1894.—It is

PROPOSED WORK

PAWTUCKET RIVER, R.I.

UPPER PART OF RIVER

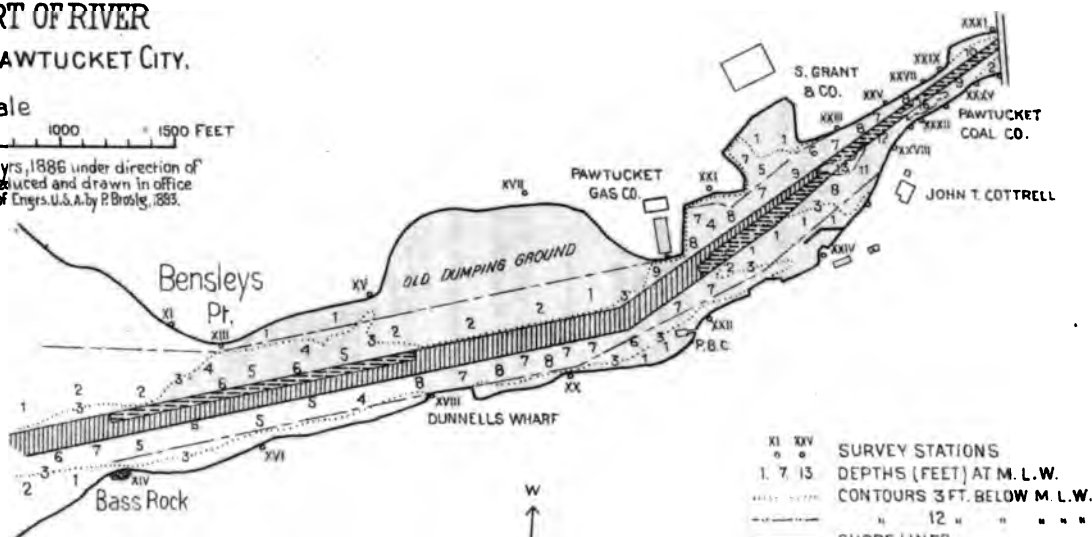
AT AND BELOW PAWTUCKET CITY.

City of Pawtucket

Scale

100 0 500 1000 1500 FEET

Based on map made by N. W. Eayrs, 1886 under direction of Lt. Col. G. H. Elliot, Engrs. U.S.A. Reduced and drawn in office of Capt. W. H. Bixby, Corps of Engrs. U.S.A. by P. Brosley, 1893.



XI XV SURVEY STATIONS

1. 7. 13 DEPTHS (FEET) AT M. L. W.

CONTOURS 3 FT. BELOW M. L. W.

" 12 " " " " "

SHORE LINES

HARBOR LINES

BENCHMARK AT DUNNELL'S WHF IS 6.82 FT. ABOVE M. L. W.

MEAN RISE AND FALL OF TIDE IS ABOUT 5.0 FT.

DREDGING PRIOR TO JUNE 30. 1892. (TO 12 FT. DEPTH AT M. L. W.)

DREDGING TO BE DONE.

NEWPORT, R.I. JULY. 1893.

Official

W. H. Bixby

CAPTAIN OF ENGRS., U.S.A.

Eng 98

proposed to apply the balance of the funds on hand and the appropriation asked for to extending the channel toward Pawtucket by dredging, and to commencing work on the ledge.

Pawtucket is in the collection district of Providence, and that port is the nearest port of entry. The amount of revenue collected at Providence in the last calendar year was $385,887.01. The nearest lighthouse is Sassafras Point Light. The nearest fortifications are Fort Adams, Newport, R. I., and the fort on Dutch Island, Rhode Island.

Money statement.

July 1, 1892, balance unexpended		$704.88
Amount appropriated by act approved July 13, 1892		35,000.00
		35,704.88
June 30, 1893, amount expended during fiscal year		1,256.65
July 1, 1893, balance unexpended		34,448.23
July 1, 1893, outstanding liabilities	$28.34	
July 1, 1883, amount covered by uncompleted contracts	13,860.00	
		13,888.34
July 1, 1893, balance available		20,559.89
Amount (estimated) required for completion of existing project		202,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for dredging in the river at Pawtucket, R. I.

[Quantity required, about $14,000 worth of work.]

No.	Bidders.	Price bid per cubic yard.		Remarks.
		On this work alone.	In connection with other work.	
		Cents.	*Cents.*	
1	R. G. Packard, New York, N. Y		42	Combination bids include work at Providence and Green Jacket Shoal.
2	Elijah Brainard, New York, N. Y	46		

Contract awarded to R. G. Packard.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Pawtucket River by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. George E. Newell, Pawtucket, R. I.):

Class of goods.	Exports.	Imports.	Totals.	Tonnage.
				Tons.
Cotton and products	$125,000		$125,000	620
Fertilizers	22,500	$37,500	60,000	1,600
Lumber and products	185,000	148,000	333,000	16,700
Coal, minerals, and products	70,000	1,096,000	1,166,000	221,000
Total	402,500	1,281,500	1,684,000	249,900

Gain over last year, none known. Transportation lines established during the year, none.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Steam:	
Freight mainly	640
Passenger mainly	300
Tugs	500
Pleasure boats	800
Barges:	
Freight	480
Sail:	
Freight	160
Pleasure boats, small	800

C 11.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY, RHODE ISLAND.

Providence River is an estuary of Narragansett Bay. The object of its improvement is to furnish a wide and deep channel for European and coastwise commerce from the ocean to Providence, a city which had in 1885 about 125,000 inhabitants, largely engaged in manufactures, and which is also a port of entry for an extensive region of country, to which it is connected by railroads. The mean rise and fall of the tide is 4.7 feet.

Original condition.—Before the improvement of the river was commenced, in 1853, many shoals obstructed navigation; and at one point in the channel, a place called The Crook, the available low-water depth was but 4½ feet.

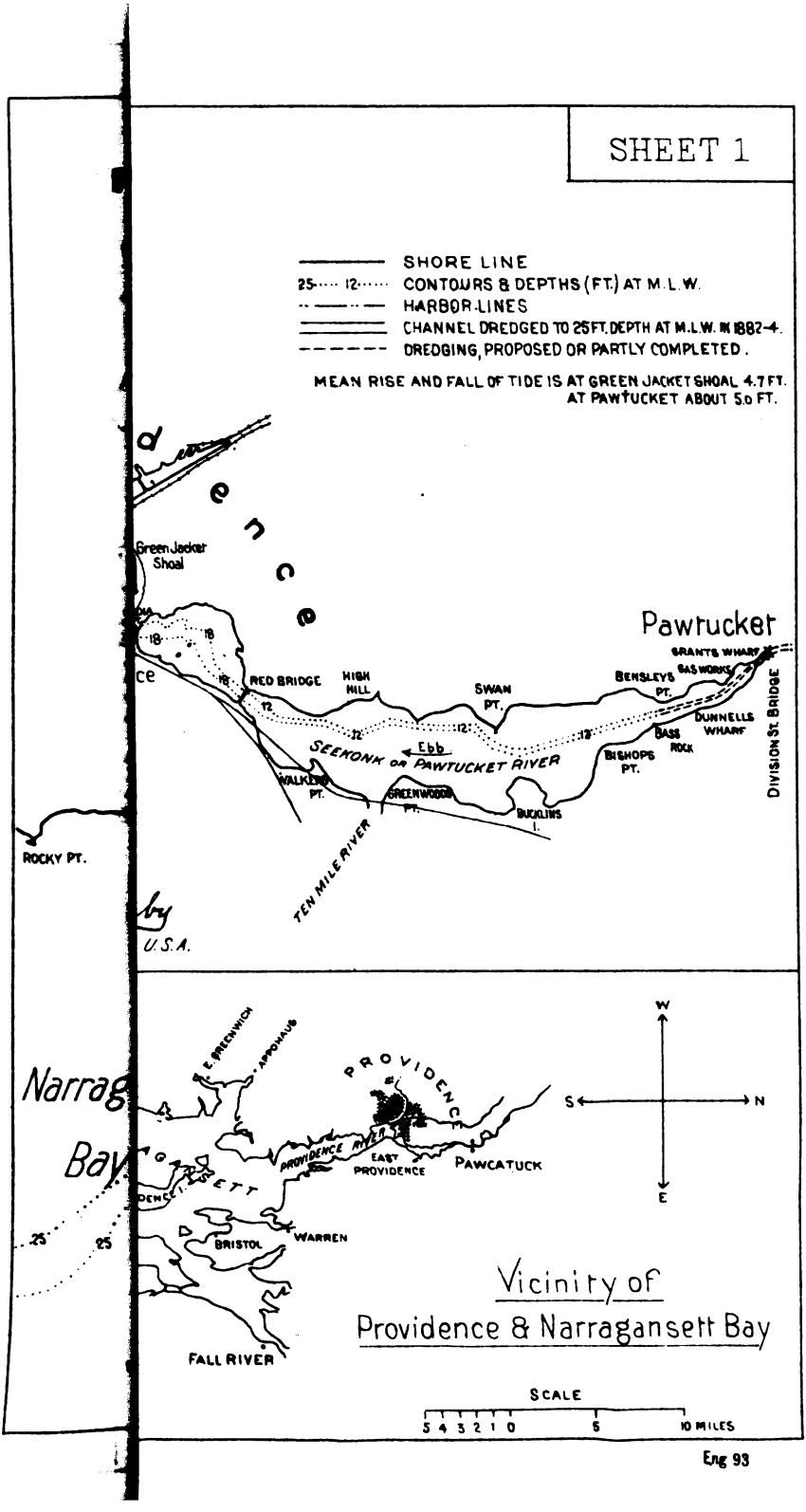
Between 1852 and 1873, $56,500 was appropriated to secure depths of first 9 and and then 12 feet at low water. This work was finished in 1873.

At the adoption of the present project the channel was limited to 12 feet depth, and the anchorage areas were much too small and shallow for the craft seeking them.

Plan of improvement.—The present approved project, that of 1878, as modified in 1882, provides for the deepening of the river and the deepening and widening of its anchorage basins, so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox to Field Point; all at a total cost estimated in 1882 at $675,000.

A plan of the works may be found at page 622, Annual Report of the Chief of Engineers for 1884, and further special information at page 235 of 1878 and 557 of 1882.

The 25-foot channel has been laid out in straight reaches (with enlargements at the angles), with a view to their being lighted later by range or leading lights, such as are used in similar cases in Chesapeake Bay, Delaware River, and other localities, if it should be found necessary.


SHEET 1
SHORE LINE
25 12 CONTOURS & DEPTHS (FT.) AT M.L.W.
HARBOR LINES
CHANNEL DREDGED TO 25FT. DEPTH AT M.L.W. IN 1882-4.
DREDGING, PROPOSED OR PARTLY COMPLETED.
MEAN RISE AND FALL OF TIDE IS AT GREEN JACKET SHOAL 4.7 FT.
AT PAWTUCKET ABOUT 5.0 FT.
Green Jacket Shoal
Pawtucket
GRANTS WHARF
GAS WORKS
BENSLEYS PT.
DUNNELLS WHARF
DIVISION ST. BRIDGE
RED BRIDGE
HIGH HILL
SWAN PT.
BASS ROCK
BISHOPS PT.
Ebb
SEEKONK or PAWTUCKET RIVER
WALKERS PT.
GREENWOOD PT.
BUCKLINS I.
ROCKY PT.
TEN MILE RIVER
U.S.A.
E. GREENWICH
APPONAUG
PROVIDENCE
PROVIDENCE RIVER
EAST PROVIDENCE
PAWCATUCK
W
S
N
E
Narragansett Bay
BRISTOL
WARREN
FALL RIVER
25
Vicinity of
Providence & Narragansett Bay
SCALE
5 4 3 2 1 0 5 10 MILES

Eng 93



Appropriations.—Upon the present project appropriations have been made as follows: 1878, $50,000; 1879, $60,000; 1880, $60,000; 1881, $60,000; 1882, $125,000; 1884, $85,000; 1886, $30,000; 1888, $40,000; 1890, $50,000; 1892, $50,000. Total up to June 30, 1893, $610,000.

Amount expended and results to June 30, 1893.—The total amount expended on the present project (including $29.95 outstanding liabilities) up to June 30, 1892, was $559,950.45, by which all the 25-feet-depth channels, most of the 20-feet-depth anchorages, and a part of the 18-feet-depth anchorages had been dredged, this being about five-sixths of all the proposed work.

Operations during the past fiscal year.—Value of United States plant, $25,600. Including $6,433.64 outstanding liabilities the expenses of the year were $10,581.47.

During the year a project has been submitted and approved for work under the new appropriations, and contract for dredging entered into with R. G. Packard, of New York City, at 11.5 cents per cubic yard, under date of February 14, approved by the Chief of Engineers February 25; work (together with that of Pawtucket River and Green Jacket Shoal, R. I.), to be commenced May 1, 1893, and to be completed April 1, 1894. Actual dredging was commenced on the 8th of May, since which time 75,489 cubic yards of mud have been excavated from 5,087 feet length and 50 feet width of cutting, very nearly completing the anchorage area on the west side of the river above Sassafras Point.

This work was under the local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—There is required for the completion of the existing project the remainder of the excavation of the anchorage basin between the head of Sassafras Point Reach and Field Point, and removal of a few shoaled portions of the 25-feet-depth channel.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance of the funds on hand and the appropriation asked for to completing the excavation of the anchorage area.

Providence River is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence in the last calendar year was $385,887.01. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are fort on Dutch Island and Fort Adams, R. I.

Money statement.

July 1, 1892, balance unexpended		$79.50
Amount appropriated by act approved July 13, 1892		50,000.00
		50,079.50
June 30, 1893, amount expended during fiscal year		4,177.78
July 1, 1893, balance unexpended		45,901.72
July 1, 1893, outstanding liabilities	$6,433.64	
July 1, 1893, amount covered by uncompleted contracts	31,318.76	
		37,752.40
July 1, 1893, balance available		8,149.32
Amount (estimated) required for completion of existing project		65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		65,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for dredging in the river at Providence.

[Quantity required: About $40,000 worth of work.]

No.	Bidders.	Price bid per cubic yard.		Remarks.
		On this work alone.	In connection with other work.	
		Cents.	*Cents.*	
1	R. G. Packard, New York		11½	Combination bids include work at Green Jacket Shoal and Pawtucket.
2	W. H. Beard Dredging Co., New York.		12½	
3	Charles and Henry Du Bois, New York.		12½	
4	Morris & Cumming Dredge Co., New York.	12½		

Contract awarded to R. G. Packard.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Providence River by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. F. P. Little, secretary of the Board of Trade, Providence, R. I.):

Class of goods.	Imports.	Tonnage.
		Tons.
Lumber and products	$222,500	31,200
Coal, minerals and products	3,500	870
Machinery and hardware	100	1
General merchandise	13,700,000	1,318,000
Total	13,926,000	1,350,000

Gain over last year: None reported. Transportation lines established during the year: None reported.

The above commerce is that merely of foreign imports; the foreign exports and coastwise imports and exports not being at present recorded by either collector or board of trade.

The passage of vessels through this water way is estimated as follows (each entrance and departure together, being counted as one passage):

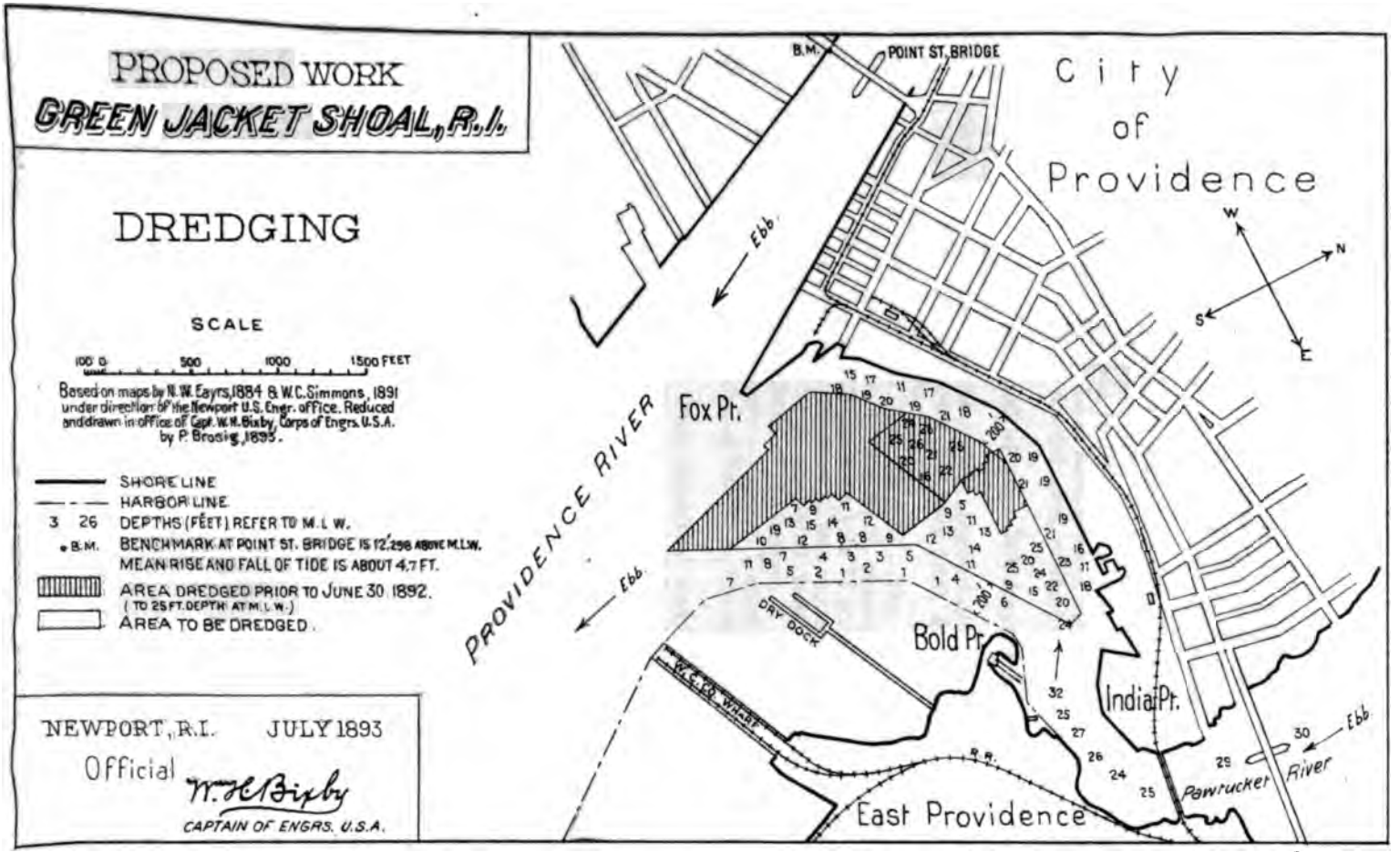
Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam, freight, and passenger	2,000	18	450
Sail, freight	3,000	15	150

C 12.

REMOVAL OF GREEN JACKET SHOAL, PROVIDENCE RIVER, RHODE ISLAND.

Green Jacket Shoal is that part of Providence River which lies off the wharves on the south front of the city, being an important part of the harbor for anchorage purposes.

Original condition.—That part of the harbor in which the shoal is


PROPOSED WORK
GREEN JACKET SHOAL, R.I.
DREDGING
SCALE
100 0 500 1000 1500 FEET
Based on maps by N. W. Eayrs, 1884 & W.C. Simmons, 1891 under direction of the Newport U.S. Engr. office. Reduced and drawn in office of Capt. W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig, 1893.
SHORE LINE
HARBOR LINE
3 26 DEPTHS (FEET) REFER TO M.L.W.
B.M. BENCHMARK AT POINT ST. BRIDGE IS 12.256 ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS ABOUT 4.7 FT.
AREA DREDGED PRIOR TO JUNE 30 1892. (TO 25 FT. DEPTH AT M.L.W.)
AREA TO BE DREDGED.
NEWPORT, R.I. JULY 1893
Official
W. H. Bixby
CAPTAIN OF ENGRS. U.S.A.
B.M.
POINT ST. BRIDGE
City of Providence
Ebb
Fox Pt.
PROVIDENCE RIVER
DRY DOCK
Bold Pt.
India Pt.
W. & P. WHARF
East Providence
Pawtucket River
W
N
S
E

Eng 93

ated is about 2,000 feet long by from 600 to 1,200 feet wide; and of s area the shoal occupied about 30 acres, that part of it which was :luded between the 15-foot curves measuring about 18 acres. There re channels on either side of the shoal between it and the harbor es, having at mean low water a width of 300 feet and a depth of 20 t on the north side, and a width varying from 50 to 100 feet and a pth of about 15 feet on the south side. The water on the summit of e shoal was only 1 foot deep.

Plan of improvement.—The present approved project, that of 1885, ovides for the removal to 25 feet depth at low water of a middle- ound shoal of about 30 acres area in Providence River opposite the y, the portion to be removed to be at least 200 feet distant from the rbor lines of the city; all at a total cost estimated in 1885 at 12,346.

A plan of the works may be found at page 598, Annual Report of e Chief of Engineers for 1885.

Appropriations.—Upon the present project appropriations have been de as follows: 1886, $26,250; 1888, $28,000; 1890, $25,000; 1892, 0,000. Total up to June 30, 1893, $89,250.

Amount expended and results to June 30, 1892.—The total amount pended on the present project (including $5.90 outstanding liabili- s) up to June 30, 1892, was $79,237.82, by which 18 acres (out of the ginal 30) had been removed to a depth of 25 feet at mean low water, ng the northern and western sides of the shoal, making an impor- nt addition to the anchorage facilities of the harbor.

Operations during the past fiscal year.—Value of United States plant, ,500. Including $20.40 of outstanding liabilities, the expenses of the ar were $356.95.

During the year a project has been submitted and approved for rk under the new appropriation, and contract for dredging was tered into with R. G. Packard, of New York City, at 11.5 cents per bic yard, under date of February 14, approved by the Chief of Engi- ers February 25; work (together with that of Pawtucket and Provi- nce rivers, Rhode Island) to be commenced May 1, 1893, and to be mpleted April 1, 1894. No dredging has yet been actually com- nced, the contractor using his plant and force first on the other rts of his contract.

This work was under the local charge of Mr. Edward Parrish, as sistant engineer.

Work required to complete the existing project.—The work required to mplete the existing project is the excavation of the eastern end of e shoal to a depth of 25 feet.

Operations contemplated for the fiscal year ending June 30, 1894.—It proposed to apply the balance on hand and the funds asked for to ntinuing the removal of the shoal according to the general project.

reen Jacket Shoal is in the collection district of Providence, which is a port of ry. The amount of revenue collected at Providence during the last calendar ar was $385,887.01. The nearest light-houses are the six light-houses in Provi- nce River. The nearest fortifications are Fort Adams, R. I., and the fort on tch Island, Rhode Island.

Money statement.

ly 1, 1892, balance unexpended	$18.08
mount appropriated by act approved July 13, 1892	10,000.00
	10,018.08
ne 30, 1893, amount expended during fiscal year	342.45
y 1, 1893, balance unexpended	9,675.63

July 1, 1893, outstanding liabilities	$20.40	
July 1, 1893, amount covered by uncompleted contracts	7,500.00	
		$7,520.40
July 1, 1893, balance available		2,155.23
Amount (estimated) required for completion of existing project		23,096.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		23,096.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for dredging at Green Jacket Shoal in the harbor at Providence, R. I.

[Quantity required: About $7,500 worth of work.]

No.	Bidders.	Price bid per cubic yard in connection with other work.	Remarks.
		Cents.	
1	R. G. Packard, New York	11½	Combination bids include work at Providence River and Pawtucket River.
2	W. H. Beard Dredging Co., New York	12½	
3	Chas. and Henry Du Bois, New York	12½	

Contract awarded to R. G. Packard.

C 13.

IMPROVEMENT OF GREENWICH BAY, RHODE ISLAND.

Greenwich Bay is an arm of Narragansett Bay, located in the towns of Warwick and East Greenwich, R. I. It has a length of about 3½ miles and an average width of 1½ miles.

Original condition.—The channel leading to the town of East Greenwich was deep enough for the demands of commerce, but its entrance was so narrow and crooked as to render navigation difficult.

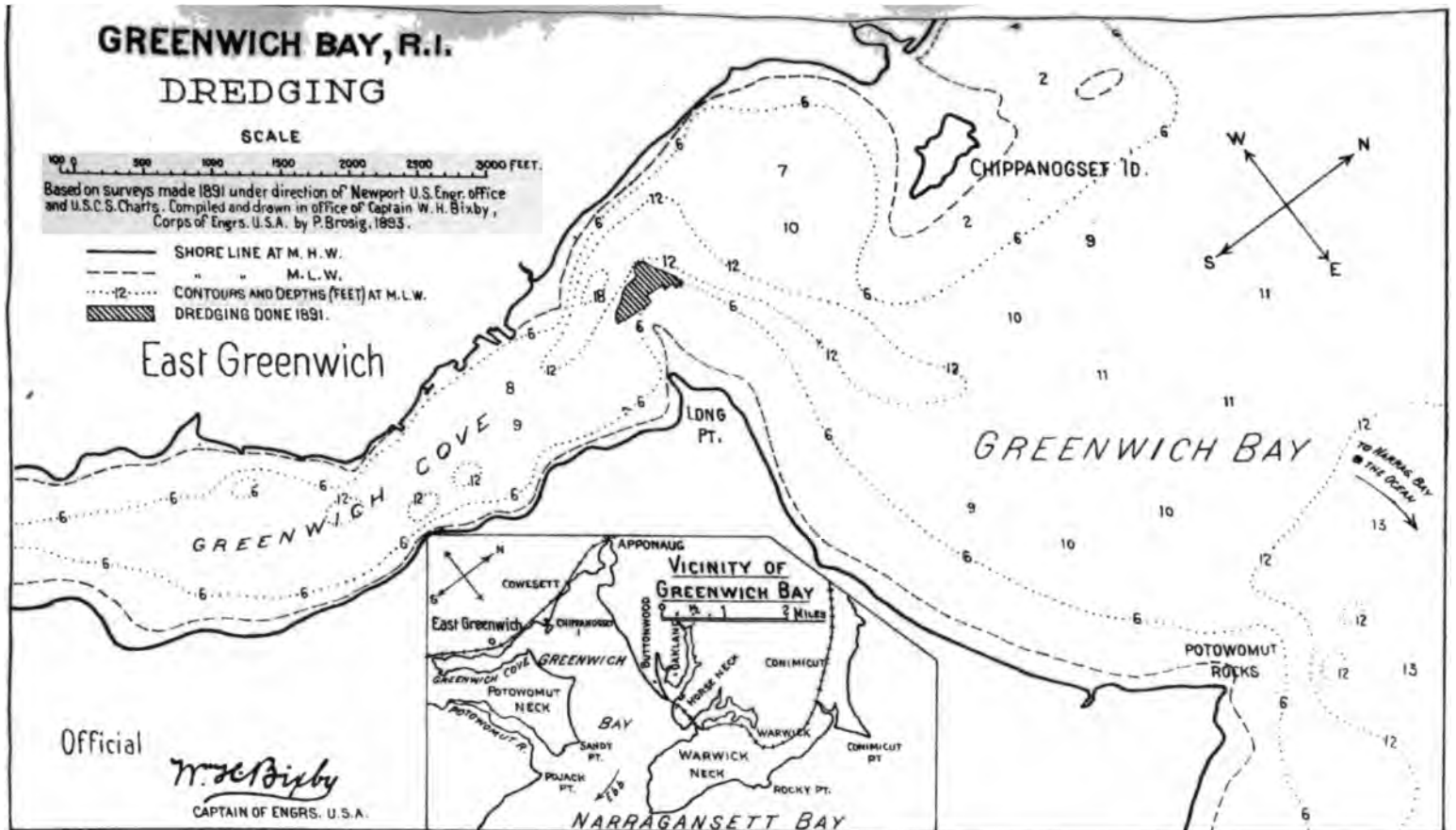
Plan of improvement.—The present approved project, that of 1888, provides for the straightening and deepening of the channel from Narragansett Bay up to the town of East Greenwich, so as to secure a channel depth of 10 feet across the bar extending out from Long Point; all at a total cost estimated in 1888 at $2,000.

A description of the works may be found at p. 650, Annual Report of the Chief of Engineers for 1889.

Appropriations.—Upon the present project appropriations have been made as follows: 1890, $2,000. Total up to June 30, 1892, $2,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $0.32 outstanding liabilities) up to June 30, 1892, was $2,000, by which the obstructions had been fairly well removed, all dredging having been completed in May, 1891, leaving a channel of 10 feet depth with 210 feet width and 500 feet length opposite Long Point, where the channel has previously been most narrow and crooked.

Operations during the past fiscal year.—Value of United States plant, $0.00. Including its outstanding liabilities, the expenses of the year were $0.00, work being confined to minor office duties.


GREENWICH BAY, R.I.
DREDGING
SCALE
100 0 500 1000 1500 2000 2500 3000 FEET.
Based on surveys made 1891 under direction of Newport U.S. Engr. office and U.S.C.S. Charts. Compiled and drawn in office of Captain W. H. Bixby, Corps of Engrs. U.S.A. by P. Brosig, 1893.
SHORE LINE AT M. H. W.
" " M. L. W.
CONTOURS AND DEPTHS (FEET) AT M.L.W.
DREDGING DONE 1891.
East Greenwich
GREENWICH COVE
LONG PT.
GREENWICH BAY
CHIPPANOGSET I.D.
TO NARRAGANSETT BAY & THE OCEAN
POTOWOMUT ROCKS
VICINITY OF GREENWICH BAY
APPONAUG
COWESETT
East Greenwich
CHIPPANOGSET
BUTTONWOOD
OAKLAND
MORSE NECK
CONIMICUT
GREENWICH COVE
GREENWICH BAY
POTOWOMUT NECK
POTOWOMUT R.
SANDY PT.
POJACK PT.
WARWICK
WARWICK NECK
CONIMICUT PT.
ROCKY PT.
NARRAGANSETT BAY
Official
W. H. Bixby
CAPTAIN OF ENGRS. U.S.A.

Eng 98

Operations contemplated for the fiscal year ending June 30, 1894.—The project being completed, no work is anticipated for the coming year.

Greenwich Bay is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence during the last calendar year was $385,887.01. The nearest fortification is the fort on Dutch Island, Rhode Island. The nearest light-house is Warwick Light.

Money statement.

July 1, 1892, balance unexpended	$0.32
June 30, 1893, amount expended during fiscal year	*.32

COMMERCIAL STATISTICS.

The commerce arriving and leaving Greenwich Bay by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. Joseph Dews, East Greenwich, R. I.):

Class of goods.	Imports.	Tonnage.
		Tons.
Lumber and products	$45,000	3,800
Coal, minerals, and products	56,000	15,000
Total	101,000	18,800

Gain over last year, none known; transportation lines established during the year, none.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Salt:			
Freight	100	12	400
Fishing boats	500		

C 14.

IMPROVEMENT OF COVE AND WATERWAY NEAR COASTER HARBOR ISLAND, RHODE ISLAND.

This cove is situated in the northwestern part of the city of Newport, R. I., near the southeastern extremity of Coaster Harbor Island, which is occupied by the U. S. Navy as a training station.

Original condition.—A causeway connecting Coaster Harbor Island with Rhode Island forms the northern boundary of the cove and separates it from the waterway above. This causeway, having but one small opening, had checked the flow of water around the island and caused deposits, so as to cause unhealthy and disagreeable odors.

At the adoption of the present project the cove was badly shoaled in some places, and the passage through the causeway was limited to 25 feet width and 1 foot depth at low tide.

Plan of improvement.—The present approved project, that of 1889, provides for the deepening of the cove and the waterway from Newport

*Deposited to credit United States Treasurer June 21, 1893.

Harbor up to the causeway crossing the cove; and for the cutting of additional openings in the causeway; so as to allow of the freer flow of water through the waterway between Coasters Island and the main land; all at a total cost estimated in 1889 at $5,500.

A description of the works may be found at p. 591, Annual Report of the Chief of Engineers for 1890, and a plan of the same, in House Ex. Doc. No. 63 of the Fifty-first Congress, first session.

Appropriations.—Upon the present project appropriations have been made as follows: 1890, $5,500; total up to June 30, 1892, $5,500.

Amount expended and results to June 30, 1892.—Total amount expended on the present project (including $186.65 outstanding liabilities) up to June 30, 1892, was $3,687.56, by which the dredging had been finished. The opening in the causeway and erection of bridges were still to be finished, this work having been stopped on the 20th of June in order that communication by land with the island of Rhode Island should not be cut off until after the completion of certain contracts by the Navy Department.

Operations during the past fiscal year.—Value of United States plant, $0.00. Including $0.00 of outstanding liabilities the expenses of the year were $1,812.44.

During the year work was resumed, having been commenced on the 4th of August and having been finished in September, leaving through the causeway four adjacent openings, each of 27 feet clear width, covered by trestle bridges.

This work was under the local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—The project being finished, no further work is contemplated.

Coaster Harbor Island is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was $3,408.83. The nearest light-house is Gull Rock Light. The nearest fortification is Fort Adams, Newport, R. I.

The commerce of this place is included in that of Newport.

Money statement.

July 1, 1892, balance unexpended	$1,999.09
June 30, 1893 amount expended during fiscal year	*1,999.09

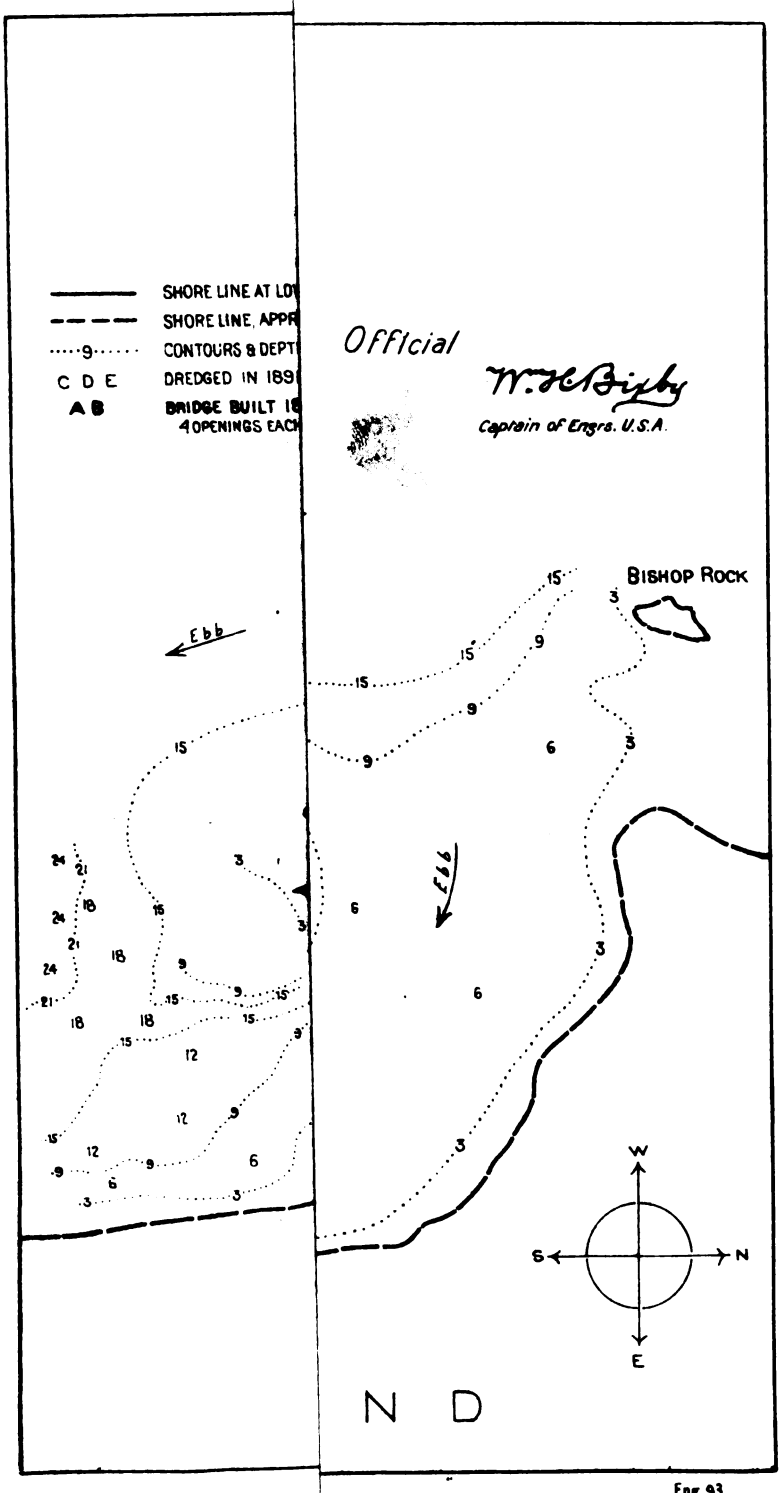
C 15.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

This harbor is at the main entrance to Narragansett Bay. This bay during the summer and winter constitutes a harbor of refuge for our European and coastwise commerce quite equal in every respect to that of New York Bay, and even more accessible. The objects of the improvement are to widen and deepen the southern (the main) entrance to the harbor, and to enlarge its capacity for vessels seeking refuge in storms by increasing the area and depth of the anchorage within it. The mean rise and fall of the tide is about 3¾ feet.

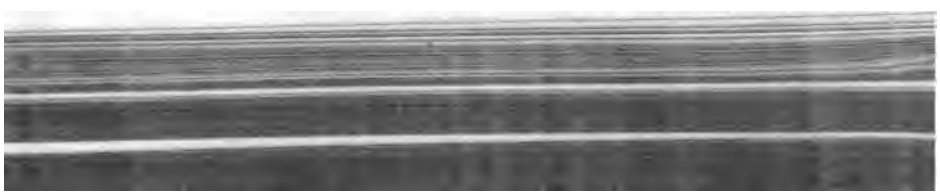
Original condition.—Before improvement the capacity of the inner harbor was limited by shoals, and it was not sufficient for the vessels

*Sixty cents deposited to credit of United States Treasurer June 21, 1893.


SHORE LINE AT LO
SHORE LINE, APPR
9 CONTOURS & DEPT
C D E DREDGED IN 189
A B BRIDGE BUILT 18
4 OPENINGS EACH
Official
W. H. Bixby
Captain of Engrs. U.S.A.
BISHOP ROCK
Ebb
Ebb
W
S
N
E
N D

Eng 93





seeking it for refuge. The southern (the main) entrance was obstructed by a bar which stretched out from Goat Island; and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet.

Between 1873 and 1875, $28,500 was appropriated to dredge a 12-foot channel up to the city wharves and build a small jetty to arrest the flow of sand into the main channel and harbor, and to protect the western face of Goat Island. (See p. 29 of Annual Report of 1873.) This work was completed in 1876.

At the adoption of the present project this harbor was limited to 12 feet depth at low water, and its anchorage area too small for the craft seeking harborage at this place during the summer and all the year during storms.

Plan of improvement.—The present approved project, that of 1880, as modified in 1882, 1883, 1884, and 1890, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water, with at least 750 feet width; for the extension of the 13-feet depth and 10-feet depth anchorage basins; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion, and to prevent the drift of sand, etc., around the island into the adjacent parts of the channel and harbor; all at a total cost estimated in 1890 at $156,200.

A plan of the work may be found at p. 604, Annual Report of the Chief of Engineers for 1885; and further details at p. 562 of 1881, p. 561 of 1882, p. 494 of 1883, p. 624 of 1884, p. 736 of 1891, and p. 627 of 1892.

Appropriations.—Upon the present project appropriations have been made as follows: 1881, $25,000; 1882, $20,000; 1884, $20,000; 1886, $15,000; 1888, $12,000; 1890, $12,500; 1892, $25,000; total up to June 30, 1893, $129,500.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $0.33 outstanding liabilities) up to June 30, 1892, was $104,498.13, by which the 15-feet-depth channels and 13-feet-depth anchorage basins had been dredged, and one jetty, 133 feet long, had been built westward from Goat Island.

Operations during the past fiscal year.—Value of United States plant, $2,800. Including $31.68 outstanding liabilities, the expenses of the year were $676.58.

During the year a project has been submitted and approved for work under the new appropriation, and contract for the dredging entered into with Charles W. Anthony, of Fall River, Mass., at 12.9 cents per cubic yard, under date of February 15, approved by the Chief of Engineers, February 25; work to be commenced May 1, and to be completed December 1, 1893; the time of commencement being afterwards extended until July 1. A tide gauge record was kept during the year. Further work now awaits the commencement of dredging by the contractor.

This work was under the local charge of Mr. Edward Parrish, as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the excavation of the 10-foot anchorage area within the harbor, the removal of Goat Island Spit to 15 feet depth, and the building of additional jetties outside of Goat Island whenever they may be required to arrest the drift of littoral sand and gravel into the harbor entrance.

Operations contemplated during the fiscal year ending June 30, 18
It is proposed to apply the funds asked for to the completion o
existing project.

Newport is in the collection district of Newport, and is a port of entry
amount of revenue collected at Newport in the last calendar year was $3,
The nearest light-houses are Lime Rock and Newport (Goat Island) lights
nearest fortification is Fort Adams, Newport, R. I.

Money statement.

July 1, 1892, balance unexpended		
Amount appropriated by act approved July 13, 1892		25,
		25,
June 30, 1893, amount expended during fiscal year		
July 1, 1893, balance unexpended		24,
July 1, 1893, outstanding liabilities	$31.68	
July 1, 1893, amount covered by uncompleted contracts	19,000.00	
		19,
July 1, 1893, balance available		5,
Amount (estimated) required for completion of existing project		26,
Amount that can be profitably expended in fiscal year ending June 30, 1895		26,
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened January 10, 1893, at Newport, R. I., by Capt. W. H. Corps of Engineers, for dredging in the harbor at Newport, R. I.

[Quantity required, about $19,000 worth of work.]

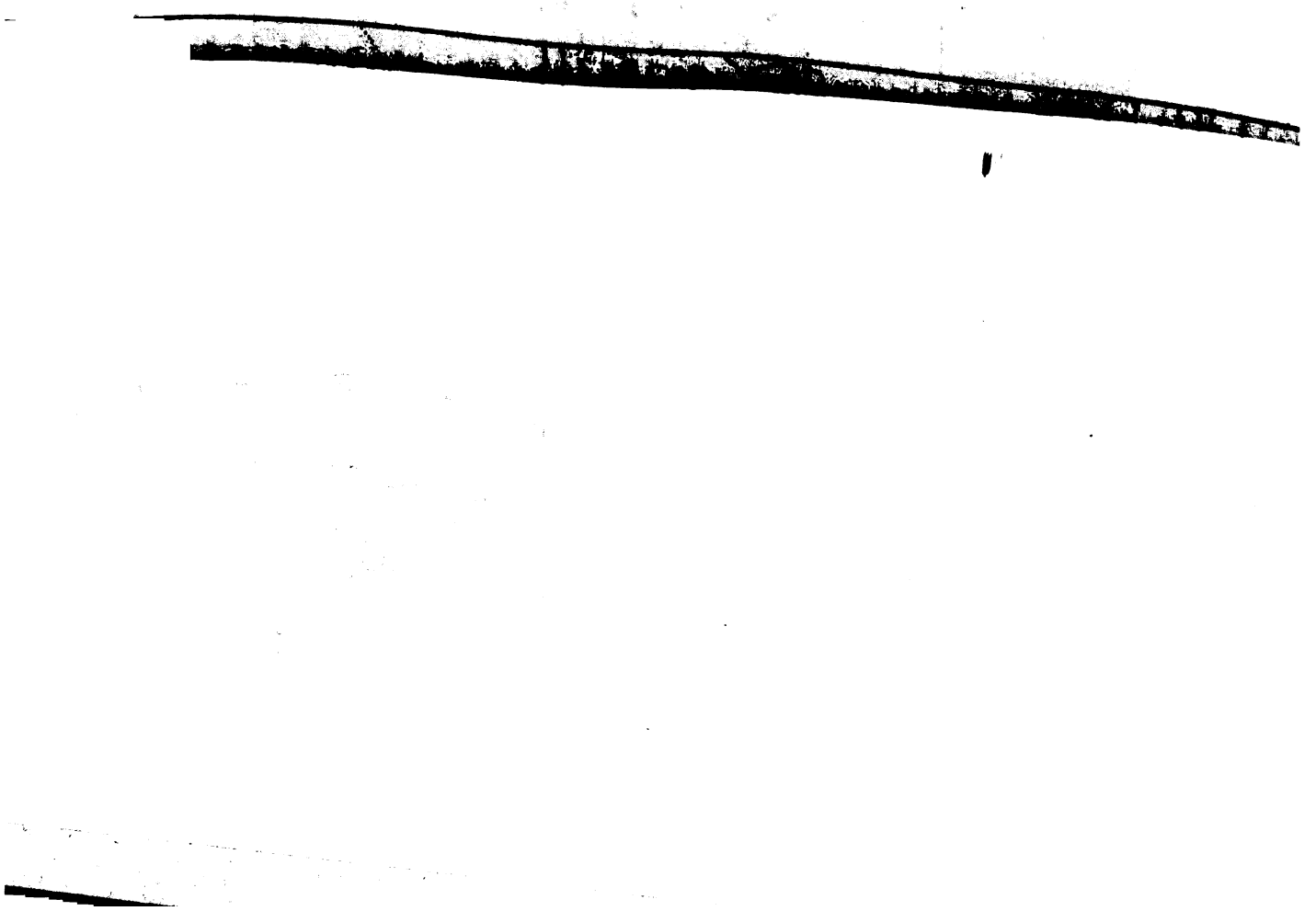
No.	Bidders.	Pr pe yar wo
1	W. H. Beard Dredging Co., New York	
2	Morris & Cummings Dredging Co., New York	
3	J. H. Fenner, Jersey City	
4	Chas. W. Anthony, Fall River, Mass	
5	Hartford Dredging Co., Hartford, Conn	

Contract awarded to Chas. W. Anthony.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Newport Harbor by water during the ca
year ending December 31, 1892, is estimated as follows (based mainly upon r
received from many and various parties):

Class of goods.	Exports.	Imports.	Total.	To
Fish, oysters, etc	$15,000	$12,000	$27,000	
Live stock and products		8,000	8,000	
Vegetables and truck		40,000	40,000	
Grain and forage		60,000	60,000	
Tobacco		25,000	25,000	
Cotton and products		30,000	30,000	
Fertilizers		56,000	56,000	
Lumber and products		150,000	150,000	
Coal, minerals, and products		320,000	320,000	
Machinery and hardware		100,000	100,000	
General merchandise	500,000	1,000,000	1,500,000	
Sundries	100,000	200,000	300,000	
Total	615,000	2,000,000	2,620,000	



Gain over last year, none. Transportation lines established during the year, none reported.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	900	12	1,500
Freight mainly	300	10	1,000
Passenger mainly	3,000	8	300
Tugs	800	7	80
Pleasure boats	1,000	5	50
Barges, freight	200	12	250
Sail:			
Freight	1,000	10	150
Fishing boats	500	6	15
Pleasure boats, large	1,000	4	5
Pleasure boats, small	2,500	2	3

C 16.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay.

Original condition.—Its shores are covered with bowlders, and a number of wrecks are scattered along the beach on each side of the point. A long ledge, known as Squid Ledge, extends for nearly a mile in a south by easterly direction about 1½ miles west of the point.

At the adoption of the present project, this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

Plan of improvement.—The present approved project, that of 1889, provides for the construction of a national harbor of refuge nearly a mile square at this point by means of stone breakwaters, planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north; all at a total cost estimated in 1889 at $1,250,000.

By the act of 13th July, 1892, authority was given to the Secretary of War to make contracts for the completion of the project, on the basis of the above-estimated total cost, the work to be paid for as appropriations may from time to time be made by law.

A description of the works may be found at page 595, Annual Report of the Chief of Engineers for 1890, and a general plan of the same, in House Ex. Doc. No. 66 of the Fifty-first Congress, first session.

Appropriations.—Upon the present projects, appropriations have been made as follows: 1890, $75,000; 1892, $75,000; 1893, $100,000; total up to June 30, 1893, $250,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $1,135.34 outstanding liabilities) up to June 30, 1892, was $74,385.08, by which a quarry was opened and quarry and floating plant built; the breakwater had been commenced at its center, about 200 feet length raised to about low level, and a beacon light established thereon.

Operations during the past fiscal year.—Value of United States plant, $14,500. Including $616.46 outstanding liabilities, the expenses of the year were $1,578.98.

During the year a full project with specifications has been submitted and approved for work under the new appropriations; the stone work to be done by contract, but superintendence and minor work to be done by hired labor and the use of the Government plant; and contract has been entered into with Hughes Brothers & Bangs, of Syracuse, N. Y., at $1.27\frac{1}{2}$ per ton of 2,000 pounds, under date of 15th of March; approved by the Chief of Engineers April 3, work to be commenced by the 1st May, 1893 (later extended until August 15), each year's future appropriation to be expended before the end of the next season thereafter. A subproject for application of the $100,000 appropriated by act of Congress of March 3, 1893, has also been submitted; approved by the Chief of Engineers, under date of the 17th April. A minor survey has been made to serve as a basis for the coming season's work. Further work now awaits the commencement of field work by the contractor.

This work was under the local charge of Mr. Edward Parrish, as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the extension of the breakwater.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance on hand and the funds asked for to continuing the construction of the breakwaters.

Point Judith is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was $3,408.83. The nearest light-house is Point Judith Light. The nearest fortification is the fort on Dutch Island, Rhode Island.

Money statement.

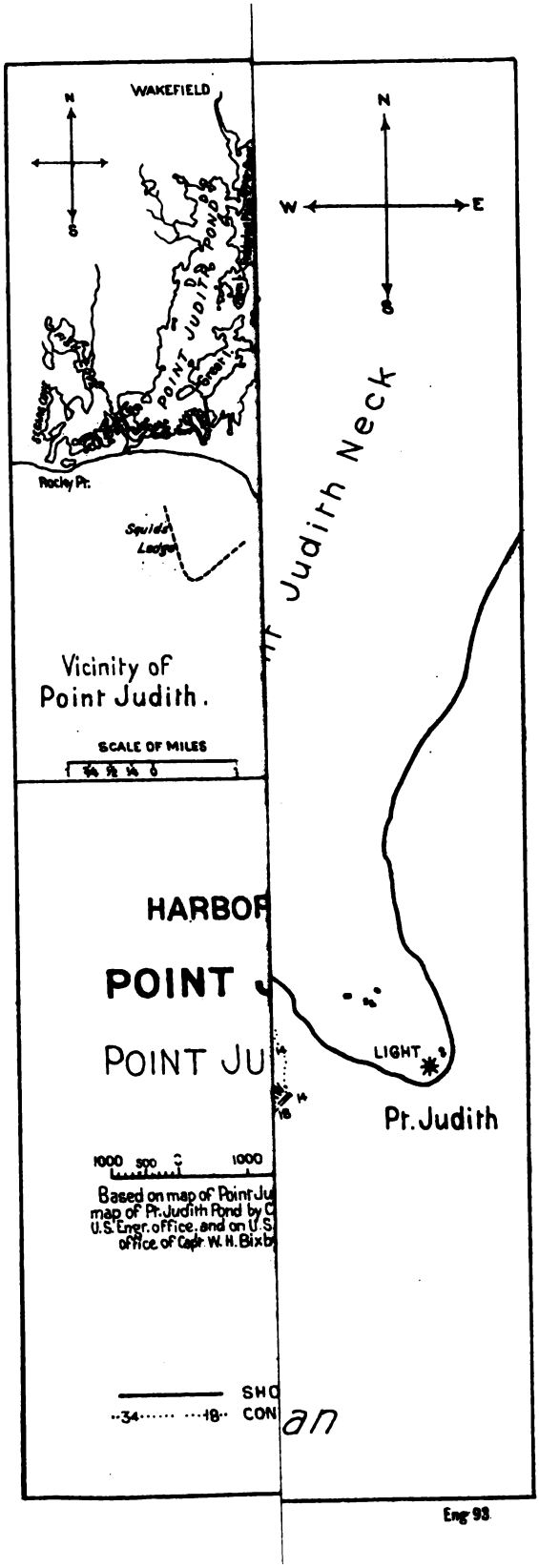
July 1, 1892, balance unexpended		$1,750.26
Amount appropriated by act approved July 13, 1892		75,000.00
Amount appropriated by sundry civil act approved March 3, 1893		100,000.00
		176,750.26
June 30, 1893, amount expended during fiscal year		2,097.86
July 1, 1893, balance unexpended		174,652.40
July 1, 1893, outstanding liabilities	$616.46	
July 1, 1893, amount covered by uncompleted contracts	132,000.00	
		132,616.46
July 1, 1893, balance available		42,035.94
Amount (estimated) required for completion of existing project		1,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals opened February 24, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for stone delivered in the breakwater at Point Judith, R. I.

[Quantity required, about $1,034,000.]

No.	Bidders.	Price bid per ton on this work alone.	
		Core stone.	Facing stone.
1	Charles N. Johnston, Somers Point, N. J., and Enough Townsend	$1.73	$1.73
2	Hughes Bros. & Bangs, Syracuse, N. Y	1.27½	1.27½
3	Humphrey Toomey, Guilford, Conn	1.95	1.95

Contract awarded to Hughes Bros. & Bangs.


WAKEFIELD
N
S
W
E
POINT JUDITH POND
Rocky Pt.
Squids Ledges
Pt Judith Neck
Vicinity of
Point Judith.
SCALE OF MILES
HARBOR
POINT
POINT JU
LIGHT
Pt. Judith
1000 500 0 1000
Based on map of Point Ju
map of Pt. Judith Pond by C
U.S. Engr. office, and on U.S.
office of Capt. W. H. Bixb
SHO
CON
an
Eng 93

COMMERCIAL STATISTICS.

The number of vessels passing Point Judith, Rhode Island, during the calendar ear ending December 31, 1891, is estimated as follows, based mainly upon reports eceived from Mr. Asa Church, keeper Point Judith Life-Saving Station, Rhode sland.

Class.	Number.	Average approximate tonnage.	Total tonnage.
		Gro. tons.	*Gro. tons.*
teamers (freight and fish)	9,223	500	4,611,500
achts (steam and sail)	5,220	100	522,000
chooners (2, 3, and 4 masts)	26,160	600	15,696,000
hips, barks, and barkentines	184	900	165,600
rigs and brigantines	195	300	58,500
loops	1,520	20	30,400
arges	6,683	300	2,004,900
Total	49,185		23,088,900

C 17.

MPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

Point Judith Pond is a shallow-draft salt pond, lying in rear of the andy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighorhood is the reopening of an old entrance long ago closed by the cean storms.

At the date of the present appropriations, made in 1892, the entrance o this pond was very shallow (less than 3 feet), crooked, and variable n location.

Plan of improvement.—There is at present no approved project for his work, it having been reported as not worthy of improvement in 1873 by Gen. Warren (pp. 286–289, Part II, Annual Report of the Chief f Engineers for 1874, and House Ex. Doc. No. 84, of the Forty-third Congress, first session), and also as not worthy of improvement in 1888 y Maj. Livermore (pp. 642–643 Annual Report for 1889).

Appropriations.—Only one appropriation has been made for this work, hat of 1892, for $7,500.

Amount expended and results to June 30, 1892.—Nothing; no funds eing on hand.

Operations during the past fiscal year.—Value of the United States plant, $0.00. Including $10.72 of outstanding liabilities the expenses f the year were $78.59.

During the year a partial project had been submitted and approved for work under the new appropriation, allowing minor work and surveys to be done by hired labor and the use of the Government plant. The locality has been inspected. A special report was submitted on the 24th of January as to the advisability of adopting a new location for the pond entrance.

So far as shown by the above and a study of the existing maps of the locality and a study of the past history of this portion of the Rhode Island coast, the expenditure of this appropriation at this place at present would not produce any permanent or useful improvement to the pond entrance. Moreover, the improvement is of an entirely local nature, and has no valid claim for its prosecution by the General Government.

Recommendations.—It is recommended that no further work be done and that the funds now left unexpended be returned to the Treasury.

Money statement.

Amount appropriated by act approved July 13, 1892	$7,500.00
June 30, 1893, amount expended during fiscal year	67.87
July 1, 1883, balance unexpended	7,432.13
July 1, 1893, outstanding liabilities	10.72
July 1, 1893, balance available	7,421.41

C 18.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

This island is part of the State of Rhode Island; is 14 miles east of Montauk Point, the eastern end of Long Island, and is about 10 miles from the nearest point of the mainland. Besides supplying the wants of the mackerel-fishing fleet and the general coast navigation the island is an important point on our shores for ocean navigation. It has a signal station connected by submarine telegraph with the mainland. Vessels are passing the island at all times and on all sides of it, and its position renders it of national importance. The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce. The mean rise and fall of the tide is about 3 feet.

Original condition.—Before the construction of the present harbor of refuge Block Island had no harbor which afforded protection for decked vessels. The only ones used were open boats, which, on the approach of storms, were hauled up on the beach by oxen. The largest of these boats were of about 10 tons burden.

Between 1870 and 1876 $285,000 was appropriated to build a breakwater for a harbor of medium-draft vessels. This work, including an inner harbor of 7 feet depth for temporary use of the Government plant, was completed in 1878. (See p. 202 of Annual Report of 1877 and p. 313 of 1879.)

In 1880, $6,000 was appropriated for dredging the inner basin to 9 feet depth. This work was completed in 1881. (See p. 390 of Annual Report of 1880 and p. 563 of 1881.)

In 1882, $19,000 was appropriated for building a sea wall on the east side of the inner basin and protecting the cliffs on east side of breakwater. (See p. 563 of Annual Report of 1882.) This work was completed in 1884.

In 1884, $15,000 was appropriated for additions to the old breakwater. (See p. 628 of Annual Report of 1884.) This money was spent in 1884–'85 in partially closing a gap in this old breakwater.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

Plan of improvement.—The present approved project, that of 1884, as modified in 1888, provides for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) for small vessels and an exterior harbor for large ones. The

basin was to be about 800 feet square and completely inclosed except at its 100-feet wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west, but an old gap near the end of this breakwater was to be filled up. The project covers the construction of the stone sea walls of the enlarged inner harbor ($46,000), the repair of the old breakwater ($24,000), and a little dredging ($5,000) along the western side of the old breakwater and also inside the harbor; all at a total cost estimated in 1888 at $75,000.

A plan of the works may be found at p. 612, Annual Report of the Chief of Engineers for 1885, and further details at pp. 609 and 613 of 1885 and p. 506 of 1888.

Appropriations.—Upon the present project appropriations have been made as follows: 1886, $20,000; 1888, $15,000; 1890, $15,000; 1892, $24,000. Total up to June 30, 1893, $74,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $91.98 outstanding liabilities) up to June 30, 1892, was $49,978.01, by which the gap in the old breakwater had been filled up so as to make the breakwater of 1,900 feet total length; the north sea wall had been built to 170 feet length with full height; then came a gap of 190 feet length; then 130 feet length to full height, then 100 feet length to high-water level, then 150 feet length to low-water level, and the west sea wall had been started 50 feet at its shore end.

Operations during the past fiscal year.—Value of the United States plant, $2,200. Including $2,959.72 outstanding liabilities the expenses of the year were $4,603.49.

During the year a project has been submitted and approved for work under the new appropriations, and contract for the stone work and fender piers entered into with Wm. H. Molthrop & Co., of New London, Conn., at $2.10 per ton for the stone work and $750 for both fender piers, under date of the 7th February, approved by the Chief of Engineers March 6, 1893; work to be commenced by 1st May and completed by 1st October, 1893. A minor survey has been made to serve as basis for the coming season's work. Stone work was commenced by the contractor on the 7th June, and 1,044 tons of stone were put in position in the harbor walls.

Considerable shoaling having occurred in the entrance way to the harbor the Government plant (1 dredge, 1 tug, and 2 scows) was moved to this place on the 30th June to clear out the obstruction.

Lights have been maintained on the north sea wall during the year, excepting July, 1892, when from want of available funds they had to be left unattended.

The work was in the local charge of Mr. Edward Parrish as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the raising and widening of the north and west walls of the enlarged inner harbor.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to apply the balance of the funds on hand and the appropriation asked for to the continuation of the work according to the existing project.

Block Island is in the Newport collection district and Newport is the nearest port of entry. The revenue collected in Newport in the last calendar year was $3,408.83. There is no duty collected at the Island. The value of the harbor is mainly as a harbor of refuge. There are several lights at the island. The nearest fortification is Fort Adams, Rhode Island.

Money statement.

July 1, 1892, balance unexpended		$113.97
Amount appropriated by act approved July 13, 1892		24,000.00
		24,113.97
June 30, 1893, amount expended during fiscal year		1,735.75
July 1, 1893, balance unexpended		22,378.22
July 1, 1893, outstanding liabilities	$2,959.72	
July 1, 1893, amount covered by uncompleted contracts	11,807.60	
		14,767.32
July 1, 1893, balance available		7,610.90
Amount (estimated) required for completion of existing project		1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals opened January 9, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for stonework and fender piers in the harbor at Block Island, R. I.

[Quantity required, about $14,000 worth of work.]

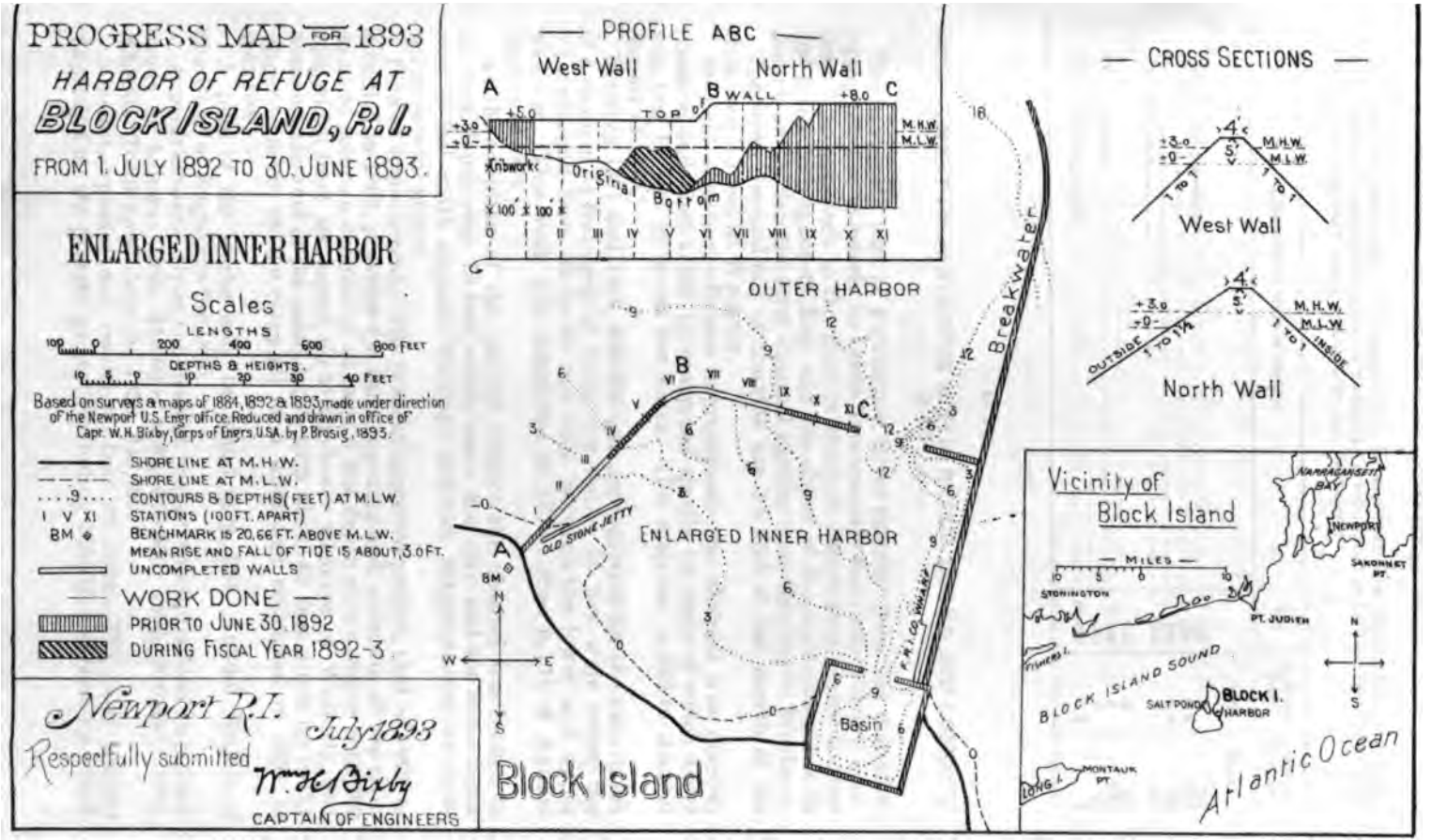
No.	Bidders.	Price bid per ton.				Remarks.
		On this work alone.		In connection with other work.		
		Fender piers.	Stone.	Fender piers.	Stone.	
1	Jas. Scully, Groton, Conn	$925	$2.18	$925	$3.18	Combination bids include work at Vineyard Haven and Nantucket.
2	Francis H. Smith, New York			2.000	2.93	
3	Jas. V. Luce, Niantic, Conn	900	2.15			
4	Wm. H. Molthrop, Gales Ferry, Conn / Benj. Stark, jr., New London, Conn	750	2.10			

Contract awarded to Wm. H. Molthrop & Co.

COMMERCIAL STATISTICS.

The commerce arriving and leaving Block Island, R. I., by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. C. C. Ball, Block Island, R. I.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
Fish, oysters, etc	$89,000	$1,800	$90,800	8,280
Live stock and products	55,500	9,500	65,000	740
Vegetables and truck	5,000	900	5,900	270
Grain and forage	500	19,300	19,800	560
Rice		1,800	1,800	10
Tobacco		18,000	18,000	30
Fertilizers		3,000	3,000	90
Lumber and products		111,200	111,200	5,170
Coal, minerals, and products		61,000	61,000	6,000
Machinery and hardware		900	900	10
General merchandise		338,600	338,600	4,500
Sundries	117,800	2,700	120,500	6,300
Total	267,800	568,100	835,800	32,000


PROGRESS MAP FOR 1893
HARBOR OF REFUGE AT
BLOCK ISLAND, R.I.
FROM 1. JULY 1892 TO 30. JUNE 1893.
ENLARGED INNER HARBOR
Scales
LENGTHS
100 0 200 400 600 800 FEET
DEPTHS & HEIGHTS
0 5 10 20 30 40 FEET
Based on surveys & maps of 1884, 1892 & 1893, made under direction of the Newport U.S. Engr. office. Reduced and drawn in office of Capt. W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig, 1893.
SHORE LINE AT M.H.W.
SHORE LINE AT M.L.W.
.9. CONTOURS & DEPTHS (FEET) AT M.L.W.
I V XI STATIONS (100 FT. APART)
BM BENCHMARK IS 20.66 FT. ABOVE M.L.W.
MEAN RISE AND FALL OF TIDE IS ABOUT 3.0 FT.
UNCOMPLETED WALLS
WORK DONE
PRIOR TO JUNE 30, 1892
DURING FISCAL YEAR 1892-3.
Newport R.I. July 1893
Respectfully submitted
Wm H Bixby
CAPTAIN OF ENGINEERS
PROFILE ABC
West Wall
North Wall
A
B WALL
C
+5.0
TOP OF
+8.0
+3.0
+0-
M.H.W.
M.L.W.
Knibwork
Original Bottom
100' x 100'
0 II III IV V VI VII VIII IX X XI
OUTER HARBOR
Breakwater
ENLARGED INNER HARBOR
OLD STONE JETTY
BM
N
W
E
S
Basin
F.R.I.R.R. WHARF
Block Island
CROSS SECTIONS
4'
5'
1 TO 1
West Wall
OUTSIDE
INSIDE
1 TO 1½
North Wall
Vicinity of Block Island
NARRAGANSETT BAY
NEWPORT
SAKONNET PT.
MILES
STONINGTON
PT. JUDITH
FISHERS I.
BLOCK ISLAND SOUND
SALT POND
BLOCK I. HARBOR
LONG I.
MONTAUK PT.
Atlantic Ocean

Eng 93

Gain over last year, none. Transportation lines established during the year, none. The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	500	7	500
Fishing	350	7.5	130
Tugs	100	7.5	130
Pleasure boats	500	7	140
Sail:			
Freight	200	9	150
Fishing boats	5,000	8	30
Oyster boats	300	7	10
Pleasure boats, small	40,000	5.5	5

C 19.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

The navigable part of Pawcatuck River extends from the manufacturing town of Westerly to Little Narragansett Bay, into which it empties. The approach to the river is through Stonington Outer Harbor and Little Narragansett Bay, and the object of the improvement is to deepen and widen the river channel leading from this bay to Westerly.

The mean rise and fall of the tide are 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

Original condition.—Before improvement the channel was narrow, crooked, and obstructed by numerous shoals, on some of which there was but 1½ feet at mean low water. (For map see p. 314 of Annual Report of 1879.)

Between 1871 and 1876, $50,000 was appropriated for the excavation of a channel 5½ feet deep at mean low water; 75 feet wide below the wharves, and from 35 to 40 feet wide between the lower and upper wharves. This work was completed in 1876. (See p. 211 of Annual Report of 1876.)

At the adoption of the present project the channel was limited to 5.5 feet depth over 75 feet width below the city and the same depth over 35 feet width opposite the city; and rock ledges crossed the channel at several points.

Plan of improvement.—The present approved project, that of 1885, as modified in 1892, provides for the deepening and widening of the river so as to secure a channel of at least 8 feet depth at low water with 100 feet width from its mouth up to the lower wharves of Westerly, and thence a channel of the same depth with about 40 feet width up to the upper wharves of the city; all at a total cost estimated in 1891 at $42,400.

A plan of the works may be found at p. 624, Annual Report of the Chief of Engineers for 1885.

Appropriations.—Upon the present project appropriations have been made as follows: 1886, $12,000; 1888, $10,000; 1890, $16,600; 1892, $3,800. Total up to June 30, 1893, $42,400.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $595.91 outstanding liabili-

ties) up to June 30, 1892, was $38,441.97, by which the 8 feet depth channel had been completed from deep water upward for full width to within a half mile of the city, and for partial width for the remaining distance.

Operations during the last fiscal year.—Value of the United States plant, $2,400. Including $78.87 outstanding liabilities, the expenses of the last fiscal year were $890.15.

During the year a project has been submitted and approved for work under the new appropriation, allowing all work to be done by hired labor and the use of the Government plant. Field work has been postponed until the fall of 1893, because the Government force could be used to better advantage elsewhere during the summer.

This work was under the local charge of Edward Parrish as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the dredging of the channel to a depth of 8 feet at mean low water and full width of 100 feet over the half mile below Westerly, and a width of 40 feet between the upper and lower wharves of that town.

Operations contemplated for the fiscal year ending June 30, 1894.—It is proposed to complete the work.

Pawcatuck River is in the collection districts of Providence and Stonington, the dividing line passing through the river. Providence and Stonington are the nearest ports of entry. The revenue collected in the last calendar year was: Providence, $385,887.01; Stonington, $1,932.26. The nearest light-houses are the Stonington and Watch Hill lights. The nearest fortification is Fort Trumbull, New London, Conn.

Money statement.

July 1, 1892, balance unexpended	$753.94
Amount appropriated by act approved July 13, 1892	3,800.00
	4,553.94
June 30, 1893, amount expended during fiscal year	1,407.19
July 1, 1893, balance unexpended	**3,146.75**
July 1, 1893, outstanding liabilities	**78.87**
July 1, 1893, balance available	**3,067.88**

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Pawcatuck River by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Messrs. Maxson & Co., Westerly, R. I.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
Grain and forage		$11,000	$11,000	600
Lumber and products	$1,500	100,000	101,500	5,100
Coal, minerals, and products	26,000	162,000	188,000	33,700
Sundries	16,000		16,000	1,900
Total	43,500	273,000	316,500	41,300

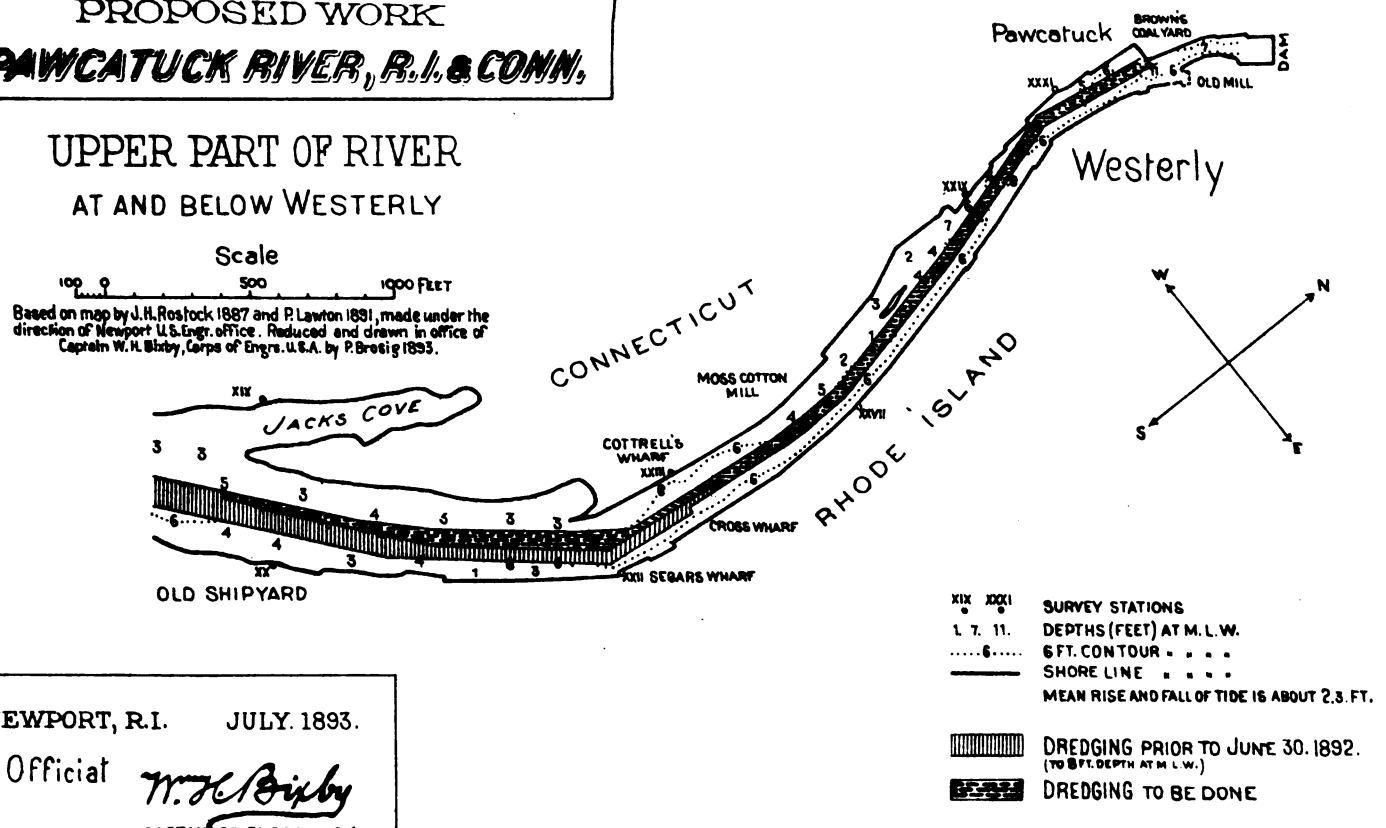
Gain over last year, none reported; transportation lines established during the year, none reported.

PROPOSED WORK

PAWCATUCK RIVER, R.I. & CONN.

UPPER PART OF RIVER

AT AND BELOW WESTERLY



NEWPORT, R.I. JULY. 1893.

Official W. H. Bixby

CAPTAIN OF ENGRS., U.S.A.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	600	8	300
Passenger, mainly	250	6	80
Tugs	600	6	75
Pleasure boats	150	3	10
Sail:			
Freight	150	8	300
Pleasure boats, large	100	3	10

C 20.

HARBOR OF REFUGE AT STONINGTON, CONN.

Stonington Harbor lies on the north side of the eastern entrance from the ocean into Long Island Sound. The main object of the improvement is to furnish a harbor of refuge for vessels entering and leaving this entrance to the Sound. The mean rise and fall of the tide is about 2¾ feet.

Original condition.—Originally it was an open bay, unprotected from southerly storms, and obstructed by a shoal having a low-water depth of but 6 feet at the shoalest part. This shoal nearly filled the inner harbor, and left but a narrow channel on either side of a depth insufficient to permit vessels of 12 feet draft to reach the upper wharves at low water.

Between 1827 and 1831, about $37,000 was spent in constructing piers or small breakwaters in the inner harbor for the protection of the harborage. (See p. 326, Part I, Annual Report of 1879.)

Between 1871 and 1873, $46,166 was appropriated for a survey of the harbor and for dredging the harbor to 12 feet depth. This work was finished in 1875. (See p. 246, Part II, Annual Report of 1874.)

Between 1875 and 1879, $112,500 was appropriated for the construction of a western breakwater, running southeast 2,000 feet from Wampasét Point to 18 feet depth of water, and for dredging to 12 feet depth inside of this breakwater. (See pp. 243, 244, 245, Part II, Annual Report of 1875.) This work was completed in 1880.

At the adoption of the present project the harbor had no eastern breakwater.

Plan of improvement.—The present approved project, that of 1880, as modified in 1882, provides for the construction of an eastern breakwater as a protection to the outer harbor; this breakwater, about a half mile long, to extend from the vicinity of Barlett Reef to the vicinity of the Middle Ground Shoal, or until it gives sufficient protection to the harbor against southerly winds; all at a total cost, estimated in 1882, at $143,000.

A plan of the works may be found at p. 598, Annual Report of the Chief of Engineers for 1882, and p. 632 of 1884; and further information at p. 585 of 1881.

The position of the ends of the eastern breakwater has not yet been definitely determined, but it will probably be found necessary, in order to afford all the protection desired, to extend the breakwater at its eastern end to Bartlett Reef, and at its western end until it intersects a range from the end of the western breakwater to the middle of Wicopessit Island, so as to thoroughly shelter the harbor from southerly storms.

Appropriations.—Upon the present project appropriations have been

made as follows: 1880, $25,000; 1881, $30,000; 1882, $25,000; 1884, $10,000; 1886, $20,000; 1888, $8,000; 1890, $12,500; 1892, $12,500. Total up to June 30, 1893, $143,000.

Amount expended and results to June 30, 1892.—The total amount expended on the present project (including $30.46 outstanding liabilities) up to June 30, 1892, was $130,491.88, by which this breakwater had been built to full height and 2,377 feet length.

Operations during the past fiscal year.—Value of United States plant, $1,200. Including $79.29 outstanding liabilities, the expenses of the year were $649.73.

During the year a partial project has been submitted and approved for work under the new appropriation, allowing minor work and surveys to be done by hired labor and the use of the Government plant. Further work has been postponed until the fall of 1893, because the Government force could be used to better advantage elsewhere until then.

A light has been maintained upon the end of the eastern breakwater during the year, except during July, 1892, when it had to be left unattended for want of funds.

This work was in the local charge of Mr. Edward Parrish, as assistant engineer.

Work required to complete the existing project.—The work required to complete the existing project is the extension of the eastern breakwater perhaps 600 feet at its eastern end and perhaps 1,300 feet at its western end, according to the results of surveys of the coming season.

Operations contemplated for the fiscal year ending June 30, 1894.—If further appropriations are made it is proposed to extend the eastern breakwater at both ends.

Stonington Harbor is in the Stonington collection district and is a port of entry. The amount of revenue collected at Stonington in the last calendar year was $1,932.26. The principal value of the harbor is as a harbor of refuge. The nearest lights are Stonington Light and Latimer Light. The nearest fortification is Fort Trumbull, New London Harbor, Connecticut.

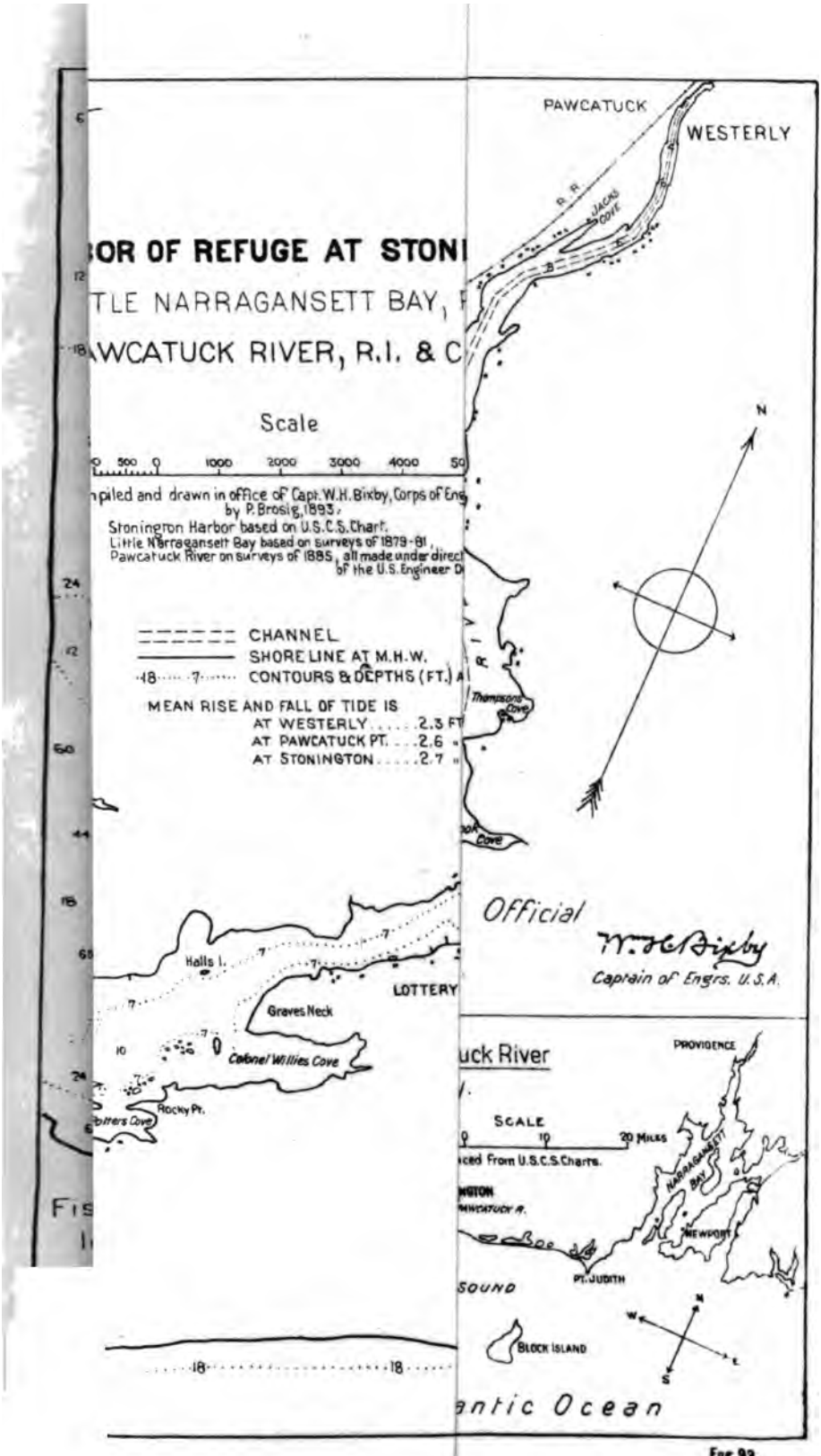
Money statement.

July 1, 1892, balance unexpended	$38.58
Amount appropriated by act approved July 13, 1892	12,500.00
	12,538.58
June 30, 1893, amount expended during fiscal year	600.90
July 1, 1893, balance unexpended	11,937.68
July 1, 1893, outstanding liabilities	79.29
July 1, 1893, balance available	11,858.39

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Stonington Harbor by water during the calendar year ending December 31, 1892, is estimated as follows (based mainly upon reports received from Mr. Charles T. Stanton, collector of customs, Stonington, Conn.):

Class of goods.	Exports.	Imports.	Total.	Tonnage.
				Tons.
Fish, oysters, etc.	$24,000		$24,000	
Grain and forage		$33,000	33,000	
Fertilizers		2,000	2,000	
Lumber and products		150,000	150,000	
Coal, minerals, and products	82,800	465,600	548,400	
General merchandise (about)	40,000,000	43,000,000	83,000,000	
Sundries		137,000	137,000	
Total (about)	40,000,000	44,000,000	84,000,000	


PAWCATUCK
WESTERLY
R.R.
JACKS COVE
OR OF REFUGE AT STONI
TLE NARRAGANSETT BAY, R
WCATUCK RIVER, R.I. & C
Scale
0 500 0 1000 2000 3000 4000 5
piled and drawn in office of Capt. W.H. Bixby, Corps of Eng
by P. Brosig, 1893.
Stonington Harbor based on U.S.C.S. Chart.
Little Narragansett Bay based on surveys of 1879-81,
Pawcatuck River on surveys of 1885, all made under direct
of the U.S. Engineer D
CHANNEL
SHORE LINE AT M.H.W.
18 7 CONTOURS & DEPTHS (FT.)
MEAN RISE AND FALL OF TIDE IS
AT WESTERLY 2.3 FT
AT PAWCATUCK PT. ... 2.6 "
AT STONINGTON 2.7 "
N
Thompsons Cove
Cove
Official
W. H. C. Bixby
Captain of Engrs. U.S.A.
Halls I.
LOTTERY
Graves Neck
Colonel Willies Cove
Rocky Pt.
Potters Cove
uck River
PROVIDENCE
SCALE
0 10 20 MILES
ced From U.S.C.S. Charts.
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Gain over last year, about 10 per cent; transportation lines established during the year, none reported.

The passage of vessels through this waterway is estimated as follows (each entrance and departure together being counted as one passage):

Character or class of service.	No.	Average draft.	Average tonnage.
		Feet.	*Tons.*
Steam:			
Freight and passenger	450	12	1,500
Freight, mainly	38	10	1,000
Passenger, mainly	80	6	100
Fishing	50	6	25
Tugs	300	7	30
Sail:			
Freight	1,000	10	150
Fishing boats	500	6	30
Pleasure boats, large	600	5	10
Pleasure boats, small	1,000	3	4

C 21.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. WRECK OF SCHOONER J. B. WOODBURY.

The wooden schooner *J. B. Woodbury* was, in the month of April, 1892, reported as being sunk in about 4 feet depth of water in location approximately 2 miles south of the Monomoy Life-Saving Station and about one-third of a mile from shore in Chatham Bay, on the west side of Monomoy Point, Southern Cape Cod, Massachusetts, and as being a dangerous obstruction to the life-saving boats and to the shallow draft sail-boat navigation of the neighborhood.

At the time (1878) when originally wrecked (by stranding) her measurements were approximately as follows: Length, 65 feet; breadth, 16 feet; depth, 7 feet; gross tonnage, 80 tons.

Under the provisions of section 4 of river and harbor act of June 14, 1880, and by direction of the Secretary of War of June 17 and of the Chief of Engineers of June 18, 1892, the destruction and removal of this wreck was authorized; work to be done by contract, after due advertisement. Subsequently and after the necessary advertisement, bids were opened on July 5, 1892 (see attached abstract of proposals), and a contract was entered into with Mr. Charles W. Johnston, of Lewes, Del., under date of July 15, approved July 28, 1892; work to be commenced July 14 and finished August 15, 1892.

This work was placed under the local charge of Assistant Engineer Edward Parrish, with Mr. B. F. Case as inspector. Work in the field was commenced July 14 and completed July 29, the entire wreck being removed to the level of the surrounding ocean bottom.

No property was recovered from the wreck.

The total cost of this work was $501.96, including the contract price and all expenses of first examination, subsequent inspection, and all other superintendence in the field and office.

Abstract of proposals opened July 5, 1892, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for removing wreck of schooner Woodbury in the bay at Chatham, Mass.

[Quantity required: whatever may be necessary for completion.]

No.	Bidders.	Price bid.
1	Charles W. Johnston, Lewes, Del	$399
2	Davis Coast Wrecking Corporation, New Bedford, Mass	500
3	Nickerson & Kendrick, Chatham, Mass	645
4	James E. Nickerson, Boston, Mass	642
5	Enoch Townsend, Somers Point, N. J	*765
6	Stephen F. Bearse, Chatham, Mass	1,800

* Includes removal of wreck *Bertha J. Fellows.*

Contract awarded to Charles W. Johnston.

2. WRECK OF SCHOONER BERTHA J. FELLOWS.

The wooden schooner *Bertha J. Fellows* was, in the month of April, 1892, reported as being sunk in about 3 feet depth of water in location approximately three-quarters of a mile north of the Monomoy Life-Saving Station, and about 500 yards from shore in Chatham Bay, on the west side of Monomoy Point, southern Cape Cod, Mass., and as being a dangerous obstruction to the life-saving boats and to the shallow draft sail-boat navigation of the neighborhood.

At the time (1885) when originally wrecked (by stranding) her measurements were approximately as follows: Length, 70 feet; breadth, 24 feet; depth, 7 feet; gross tonnage, 90 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of June 17 and of the Chief of Engineers of June 18, 1892, the destruction and removal of this wreck was authorized; work to be done by contract, after due advertisement. Subsequently and after the necessary advertisement, bids were opened on July 5, 1892 (see attached abstract of proposals), and a contract or agreement was entered into with Mr. F. F. Bearse, of Chatham, Mass., under date of July 14, approved July 26, 1892; work to be commenced July 16 and finished September 1, 1892.

This work was placed under the local charge of Assistant Engineer Edward Parrish, with Mr. B. F. Case as inspector. Work in the field was commenced July 21 and completed July 24, 1892, the entire wreck being removed to the level of the surrounding ocean bottom.

No property was recovered from the wreck.

The total cost of this work was $342.92, including the contract price and all expenses of first examination, subsequent inspection, and all other superintendence in the field and office.

Abstract of proposals opened July 5, 1892, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for removing wreck of schooner Bertha J. Fellows in the bay at Chatham, Mass.

[Quantity required: whatever may be necessary for complete work.]

No.	Bidders.	Price bid.
1	F. F. Bearse, Chatham, Mass	$275
2	Charles W. Johnston, Lewes, Del	299
3	T. H. Gill, Chatham, Mass	357
4	Davis Coast Wrecking Corporation, New Bedford, Mass	400
5	Nickerson & Kendrick, Chatham, Mass	395
6	James E. Nickerson, Boston, Mass	593
7	Enoch Townsend, Somers Point, N. J	*765
8	Stephen F. Bearse, Chatham, Mass	1,100

* Includes removal of wreck, *J. B. Woodbury.*

Contract awarded to F. F Bearse.

3. WRECK OF SCHOONER DAVIS BROTHERS.

The wooden schooner *Davis Brothers* was, in the month of August, 1892, reported as being sunk in about 13 feet depth of water in location approximately 300 yards southwest of the west ferry wharf of Conanicut Island, in Dutch Island Harbor, Narragansett Bay, Rhode Island (having entered this place on fire in June, 1891, and then having been scuttled, stripped, and left in this place by her owners), and as being a dangerous obstruction to the steam and sail boat navigation of the neighborhood, and as having caused recent damage to such craft.

At the time when originally wrecked this vessel was loaded with lime, and her measurements were approximately as follows: Length, 75 feet; breadth, 26 feet; depth, 8 feet; gross tonnage, 142 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of September 23 and of the Chief of Engineers of September 24, 1892, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

The work was placed under the local charge of Assistant Engineer Edward Parrish, with Mr. Theodore McMahon as diver and inspector. Work in the field was commenced on the 13th and completed on the 20th October. The wrecking plant consisted of a small steam lighter and small boats, provided with dynamite, electric fuses, and a firing battery. Five hundred and fifty-four pounds of dynamite completely broke up and scattered the cargo and old hull. Everything liable to cause further trouble was pulled up out of way upon the neighboring beach, the place of the wreck being cleared down to a level of 14 feet below low water, this being about a foot below the level of the surrounding bottom.

No property of value was recovered from the wreck.

The total cost of this work was $774.25, including all expenses of first examination, subsequent inspection, and all other superintendence in the field and office.

4. WRECK OF SCHOONER FRANCIS EDWARDS.

The wooden schooner *Francis Edwards* was in the month of October, 1892, reported as lying in about 10 feet depth of water in location approximately 100 feet south of Crow Island, in the inner harbor of Fairhaven, opposite New Bedford, Mass. (having in May, 1892, been found adrift in Vineyard Sound, then towed into port, run aground, stripped, and left by her finders and owners in the shallow water of the above harbor), and as being a dangerous obstruction to the shallow draft sailboat navigation of the neighborhood.

At the time when originally wrecked this vessel was loaded with spars and lumber and her measurements were approximately as follows: Length, 104 feet; breadth, 29 feet; depth, 9 feet; gross tonnage, 214 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of January 21 and of the Chief of Engineers of January 23, 1893, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

This work was placed under the local charge of Assistant Engineer Edward Parrish, with Mr. Theodore McMahon as diver and inspector. Work in the field was commenced on March 1 and completed on March

14, 1893. The wreck was found to be badly water-logged, and its hulk firmly and considerably embedded in the mud. Three hundred pounds of dynamite, fired by electricity, was used in breaking up and dislodging the wreck. All parts were removed down to a little below the level of the surrounding harbor bottom.

No property was recovered from the wreck.

The total cost of the work was $405.69, including all expenses of first examination, subsequent inspection, and all other superintendence in the field and office.

5. WRECK OF SCHOONER GEORGE S. TARBELL.

The three-masted wooden schooner *George S. Tarbell* was in the month of November, 1892, reported as being sunk in about 80 feet depth of water in location approximately 5 miles southwest of Vineyard Sound light-ship, at the western entrance to Vineyard Sound, Massachusetts, and its masts and rigging as being a dangerous obstruction to the deep and shallow draft, steam and sail boat navigation of the neighborhood.

At the time (November, 1892), when originally wrecked (sinking by collision) this vessel was loaded with plaster; and her measurements were approximately as follows: Length, 139 feet; breadth, 32 feet; depth, 15 feet; gross tonnage, 525 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of December 15 and of the Chief of Engineers of December 16, 1892, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

This work was placed under the local charge of Assistant Engineer Edward Parrish, with Mr. Theodore McMahon as diver and inspector. The wrecking plant consisted of a tug and small boat, provided with dynamite, electric fuses, and a firing battery, with which the masts and rigging were to be removed. Specially bad weather prevented field work during a portion of the time, allowing work on only three days out of sixteen; but work in the field was finally commenced February 13 and completed February 28; the entire wreck being removed to a level of 65 feet below mean low water, this being about 15 feet above the level of the surrounding ocean bottom.

No property was recovered from the wreck, except a few pieces of the mast not considered worth selling.

The total cost of the work was $995.31, including all expenses of first examination, subsequent inspection, and other superintendence in the field and office.

6. WRECK OF COAL BARGE SOOLOO.

The wooden coal barge *Sooloo* was in the month of December, 1892, reported as being sunk in about 28 feet of water in location approximately 3,500 yards northeast of Pollock Rip light vessel, near the bell buoy in Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachusetts (having bumped on the adjacent shoals in endeavoring to avoid the sunken *Alva*), and as being a dangerous obstruction to the deep and shallow draft steam and sail boat navigation of the neighborhood.

At the time (November, 1892) when originally wrecked (foundering in a storm) this vessel was loaded with coal; and her measurements

were approximately as follows: Length, 164 feet; breadth, 34 feet; depth, 23 feet; gross tonnage, 962 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of January 21 and of the Chief of Engineers of January 24, 1893, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant. Subsequently an agreement was entered into with Mr. Charles W. Johnston (then at work upon another wreck near by), under date of March 21, approved March 25, 1893, work to be commenced during his other work and finished as soon as possible.

This work had meanwhile been placed under the local charge of Assistant Engineer J. H. Rostock, with Mr. Theodore McMahon as diver and inspector. By the time that the work of actual removal of the wreck was commenced the ocean storms and currents had scoured away the shoal to a further depth of 3 feet, so that the few remnants of the wreck then lay in about 31 feet depth of water. Work upon this wreck was commenced by Mr. Johnston on April 29 and ended on the same day, a fortunate chance allowing this day to be fully utilized for active field work. During this day of field work about 60 pounds of dynamite were exploded around the wreck in small charges of from 10 to 30 pounds each, by which the remaining parts of the hull of the wreck were entirely broken up and scattered over the ocean bottom. A final inspection made on the same day showed that everything had been removed down to a level of 31 feet below low water, this being the general level of the surrounding bottom.

No property of any value was recovered, and no attempt was made to do so, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work, or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of the work was $411.93, including all expenses of first examination, subsequent inspection, and other superintendence in the field and office.

7. WRECK OF COAL BARGE STORM KING.

The wooden coal barge *Storm King* was in the month of December, 1892, reported as being sunk in 15 feet depth of water in location approximately 5,000 yards due north of the Pollock Rip light vessel, eastern entrance to Nantucket Sound, Massachusetts (having bumped on the adjacent shoals in endeavoring to avoid the sunken *Alva*), and as being a dangerous obstruction to the shallow draft steam and sail boat navigation of the neighborhood.

At the time (November, 1892) when originally wrecked (foundering in a storm) this vessel was loaded with coal, and her measurements were approximately as follows: Length, 189 feet; breadth, 37 feet; depth, 24 feet; gross tonnage, 1,261 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of January 21, and of the Chief of Engineers of January 24, 1893, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant. Subsequently an agreement was entered into with Mr. Charles W. Johnston (then at work upon another wreck near by), under date of March 21, approved March 25, 1893, work to be commenced during his other work and finished as soon as possible.

This work had meanwhile been placed under the local charge of Assistant Engineer J. H. Rostock, with Mr. Theodore McMahon as diver and inspector. By the time that the work of actual removal of the wreck was commenced, the ocean storms and currents had scoured away the shoal to a further depth of 7 feet, so that the few remnants of the wreck then lay in about 21 feet depth of water. Work upon this wreck was commenced by Mr. Johnston on the 20th of April and ended on the 27th of April, during which time the weather was such that only two days could be utilized for active field work. During these two days of field work, about 50 pounds of dynamite were exploded around the wreck in small charges of from 10 to 30 pounds each, by which the remaining parts of the hull of the wreck were entirely broken up and scattered over the ocean bottom. A final inspection made on the 28th of April showed that everything had been removed down to a level of 22 feet below low water, this being the general level of the surounding bottom.

No property of any value was recovered; and no attempt was made to do so, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work, or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of the work was $399.12, including all expenses of first examination, subsequent inspection and other superintendence in the field and office.

8. WRECK OF BARK R. A. ALLEN.

The three-masted wooden bark *R. A. Allen* was in the month of December, 1892, reported as being sunk in 18 feet depth of water on the eastern edge of Handkerchief Shoal, west of Monomoy Point, southern Cape Cod, Massachusetts, and as being a dangerous obstruction to the shallow draft sailboat navigation of the neighborhood, and as having caused recent damage to such craft.

At the time (1867) when originally wrecked (by stranding) this vessel was loaded with coal, and her measurements were approximately as follows: Length, 130 feet; breadth, 30 feet; depth, 19 feet; gross tonnage, 576 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of January 21, 1893, and of the Chief of Engineers of the same date, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant. Subsequently an agreement was entered into with Mr. George W. Johnston (then at work upon another wreck near by), under date of March 22, approved March 27, 1893, work to be commenced during his other work and finished as soon as possible.

This work had meanwhile been placed under the local charge of Assistant Engineer J. H. Rostock, with Mr. Theodore McMahon as diver and inspector. By the time that the work of actual removal of the wreck was commenced, the ocean storms and currents had somewhat shifted her position, but had not much changed her condition otherwise. Work upon this wreck was commenced by Mr. Johnston on April 3 and ended on April 24, during which time the weather was such that only seven days could be utilized for active field work. During these seven days of field work about 650 pounds of dynamite were exploded around and inside of the wreck in small charges of from 10

to 30 pounds each, by which the remaining parts of the hull of the wreck were entirely broken up and scattered over the ocean bottom. A final inspection made on April 24 showed that everything had been removed down to a level of 19 feet below low water, this being about 2 feet above the general level of the surrounding bottom, but about 1 foot below the level of the bottom of the route over which approaching boats must come.

No property of any value was recovered, and no attempt was made to do so, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work, or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of the work was $933.37, including all expenses of first examination, subsequent inspection, and other superintendence in field and office.

9. WRECK OF SCHOONER CHARLOTTE FISH.

The two-masted wooden schooner *Charlotte Fish* was, in the month of December, 1892, reported as being sunk in 32 feet depth of water in location approximately 4 miles south of Monomoy Light-House, southern Cape Cod, Massachusetts, and as being a dangerous obstruction to the deep and shallow draft steam and sail boat navigation of the neighborhood.

At the time (December, 1892) when originally wrecked (foundering in a storm) this vessel was loaded with coal, and her measurements were approximately as follows: Length, 105 feet; breadth, 27 feet; depth, 10 feet; gross tonnage, 234 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of January 21, and of the Chief of Engineers of January 23, 1893, the destruction and removal of this wreck was authorized; work to be done by contract after due advertisement. Subsequently, and after the necessary advertisement, bids were opened on the 8th of March, 1893 (see attached abstract of proposals), and a contract was entered into with Messrs. Johnston & Townsend, of Somers Point, N. J., under date of March 16, approved March 25, 1893; work to be commenced May 13 and finished in two months thereafter.

This work was placed under the local charge of Assistant Engineer J. H. Rostock, with Mr. Theodore McMahon as diver and inspector. By the time that the work of actual removal of the wreck was commenced, the ocean storms and strong currents of this vicinity had drifted the wreck considerably to the eastward and had then about completely broken up her hull and scattered her cargo, leaving only her bow, one of her spars, a few portions of her hull, and her anchors and chains. Work upon this wreck was commenced by Mr. Johnston on the 1st of April and ended on the 26th of April, during which time the weather was such that only four days could be utilized for active field work. During these four days of field work, about 200 pounds of dynamite were exploded around the wreck in small charges of from 10 to 30 pounds each, by which the remaining parts of the hull of the wreck were entirely broken up and scattered over the ocean bottom. A final inspection, made on the 1st of May, showed everything had been removed to a level of 33 feet below low water, this being about the general level of the then surrounding bottom.

No property of any value was recovered, and no attempt was made

to do so, since the cost of such work would have been greater than the value of the material saved (either through the direct expense of such work, or the delay thereby caused to the main work of destruction of the wreck itself).

The total cost of the work was $1,548.29; including the contract price and all expenses of first examination, subsequent inspection, and other superintendence in field and office.

The experience of this work is, in my opinion, entirely against the mere destruction of wrecks being done by advertisement and contract, first, because,of the long delay (usually two months) necessary for the advertisement and the formalities of the contract, during which time the wreck is liable to cause other wrecks; and, second, because of the still greater interval (usually three months) between the preparation of specifications and the actual commencement of field work, during which the condition of the wreck may be so changed by storms that specifications must be to a large extent delusive, and bids to a large extent guesswork. In this particular case, work by hired labor would have probably saved at least a month's delay (and its danger to shipping) and a large percentage of the total cost of the work.

Abstract of proposals opened March 18, 1893, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for removing wreck of schooner Charlotte Fish, Nantucket Sound, southwest of Monomoy Island, Massachusetts.

[Quantity required: Whatever may be necessary for complete work.]

No.	Bidders.	Price bid.
1	Charles W. Johnston & Enoch Townsend, Somers Point, N. J	$1,195.00
2	Davis Coast Wrecking Co., New Bedford, Mass	2,495.00

Contract awarded to Johnston & Townsend.

10. OLD WRECK IN NANTUCKET HARBOR.

A portion of a wooden schooner (name unknown) was in the month of May reported as lying sunk in 9 to 11 feet depth of water in location approximately opposite the end of the eastern jetty and in the middle of the channel entrance to Nantucket Harbor, Massachusetts (the schooner itself having lain wrecked for a year or more on the beach of Coatue Point outside the jetties, and having been cut to pieces and scattered by the ice of the past winter), and as being a dangerous obstruction to the steam and sail boat navigation of the neighborhood.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of May 16, and of the Chief of Engineers of May 17, 1893, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

Subsequently under Theodore McMahon as diver and inspector, work in the field was commenced on the 1st of June, 1893, and completed on the same day; a portion of the stem or stern of the old vessel, found firmly embedded in the ground and projecting well above its general surface (in such way as to be of a very dangerous character), and other minor portion of the old wreck, were unearthed and broken up by a few charges of dynamite; and the larger fragments were hauled up on the adjacent beach well above high-water mark; the entire wreck being

removed to a level of 11 feet below mean low water, this being about the level of the surrounding channel bottom.

No property was recovered from the wreck.

The total cost of this work was about $150, including all expenses of superintendance in the field and office.

11. OLD WRECK IN EDGARTOWN HABBOR.

A wooden schooner (name unknown) was in the month of May, 1893, reported as being sunk in 6 to 18 feet depth of water in location approximately 0.6 miles southeast of Edgartown, Marthas Vineyard, Mass., on the eastern shore of its harbor (having stranded at this place a few years ago, and having been cut down to the water's edge by the ice of the past winter) and as being a dangerous obstruction to the deep and shallow draft steam and sail boat navigation of the neighborhood.

Under the provision of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of May 17, 1893, and of the Chief of Engineers of the same date the destruction and removal of this wreck was authorized; work to be done by hired labor and the use of the Government plant. Subsequently, under Theodore McMahon as diver and inspector, work in the field was commenced June 26 and completed June 28, 1893. The bow, stern, and portions of the sides of the vessel, being found still standing, were broken up by 50 pounds of dynamite in six successive charges, and such large fragments as appeared dangerous to leave were hauled upon the beach above high-water mark, the entire wreck being removed to the level of the surrounding harbor bottom.

No property was recovered from the wreck.

The total cost of this work was about $130, including all expense of superintendence in the field and office.

12. WRECK OF STEAM YACHT ALVA.

The steel steam yacht *Alva* was in the month of October, 1892, reported as being sunk in about 22 feet depth of water in location approximately 1 mile northeast of Pollock Rip Light Vessel in the middle of Pollock Rip Channel, eastern entrance to Nantucket Sound, Massachusetts, and as being a dangerous obstruction to the deep and shallow draft steam and sail-boat navigation of the neighborhood.

At the time (July, 1892) when originally wrecked (by collision) this vessel was on a pleasure trip, and therefore without special cargo. Her measurements were approximately as follows: Length, 256 feet; breadth, 32 feet; depth, 18 feet; gross tonnage, 1,151 tons.

Shortly after sinking this vessel was sold to a wrecking company, who worked upon her about three months in the hopes of floating her and removing her in an entirety. She was, however, abandoned by them on November 23, 1892.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of October 22, 1892, and of the Chief of Engineers of the same date, the destruction and removal of this wreck was authorized, work to be done by contract after due advertisement. Subsequently, and after the necessary advertisement, bids were opened on December 3, 1892 (see attached abstract of proposals), and a contract or agreement was entered into with Messrs. Kelly and Van Sant, of Atlantic City, N. J., under date of December 12, approved December 29, 1892, work to be commenced January 14, and finished May 14, 1893.

Specially bad weather prevented field work during a portion of the winter and spring, on account of which the contractor was authorized to delay commencement until March 15, and completion until July 15, 1893; but finally under Mr. J. H. Rostock as assistant engineer, and Mr. Theodore McMahon as diver and inspector, work in the field was commenced by the contractor on March 15, 1893, and practically completed at the end of June, 1893.

Over 7,500 pounds of dynamite were exploded in and around the wreck, by which the sides and ends were cut down to the level of the surrounding bottom (about 30 feet below low water), and the center and rest of the wreck was blown down to at least 24 feet below mean low water. Final inspection is yet to be made.

No property was recovered from the wreck.

The total cost of the work has been about $7,100, including all expenses of first examination, subsequent inspection, and other superintendence in the field and office.

The experience of this wreck is greatly against such work as this being done by advertisement and contract; first, because of the long delay (usually two months) necessary for the advertisement, and the formalities of the contract, during which time the wreck is liable to cause other wrecks; and second, because of the still greater interval (usually three months) between the preparations of specifications and the actual dates of field work, during which time the condition of the wreck, and surroundings may be so changed by storms that specifications must be to a large extent delusive, and bids to a large extent guess work; and third, because the lowest bidder under such circumstances is not generally the best man for the work. In this particular case, if advertisement had been omitted and the work either done by the Government by its own hired labor or awarded in open market the wreck might have easily been destroyed and scattered before the commencement of last winter. As it was, the two months' delay for advertisement and contract deferred action in the field until after the commencement of the stormy winter season when work was impossible, and prevented work until late this spring, causing six months delay; during all of which this wreck has been a great danger to thousands of boats, three of which have been wrecked thereby. The value of these three wrecked boats would have much more than paid for the entire open market cost of the entire and rapid destruction of the *Alva*.

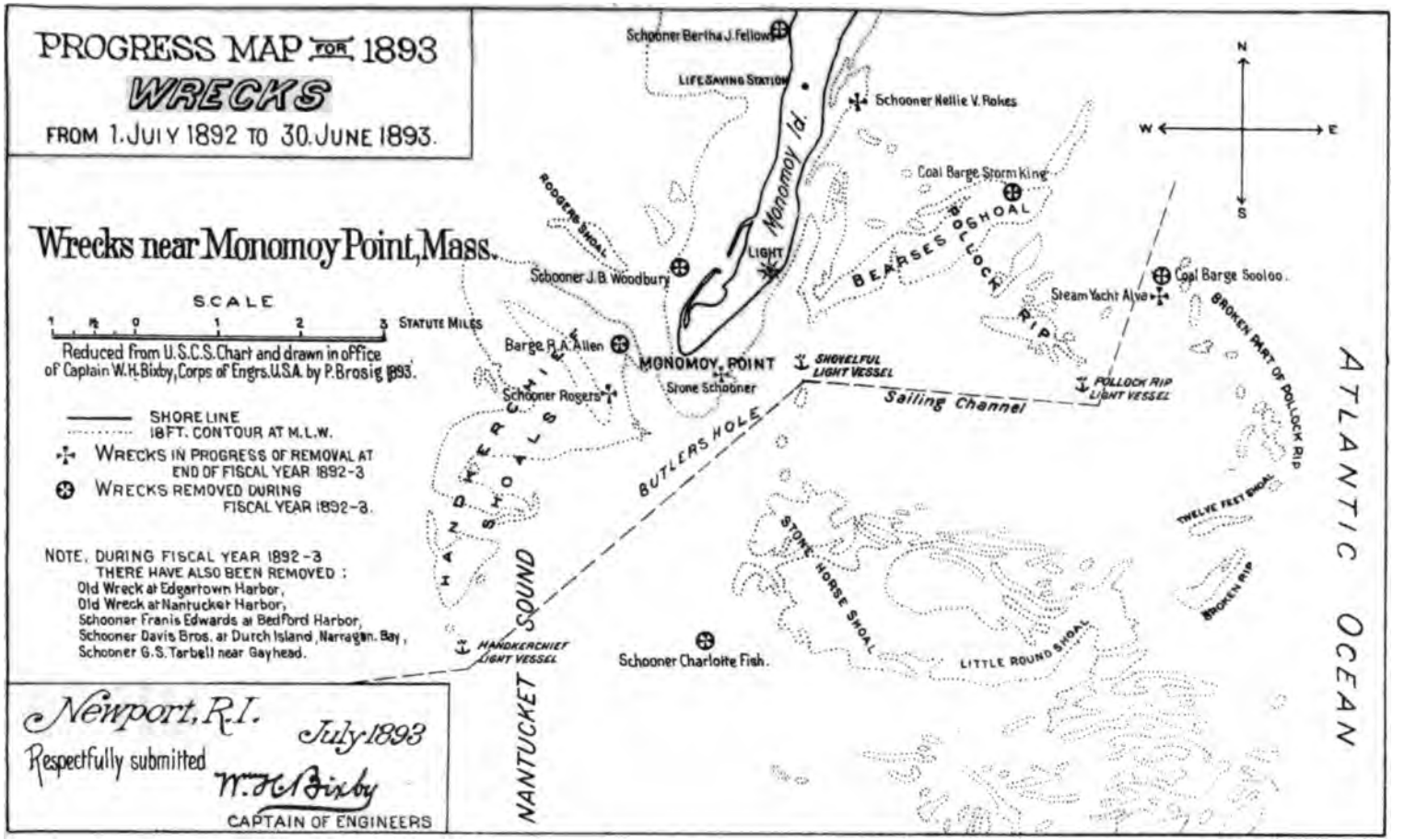
Again the experience of this wreck has shown the advantage of not attempting to save any of the cargo. Had it been required that the cargo should have been saved and carried ashore for sale the cost of the work would have been several times increased and the time necessary for the removal of the obstruction would have been nearly doubled.

Abstract of proposals opened December 3, 1892, at Newport, R. I., by Capt. W. H. Bixby, Corps of Engineers, for removing wreck of steam yacht Alva, in the channel at Pollock Rip, Nantucket Sound, Massachusetts.

[Quantity required: Whatever may be necessary to complete the work.]

No.	Bidders.	Price bid.
1	Charles W. Johnson, Lewes, Del., and Enoch Townsend: Somers Point, N. J	$12,395
2	Chapman Derrick and Wrecking Company, New York City	16,874
3	Cornelius J. Kelly, Atlantic City, and Gilbert S. Van Sant	5,916

Contract awarded to Kelly & Van Sant, of Atlantic City, N. J.


PROGRESS MAP FOR 1893
WRECKS
FROM 1. JULY 1892 TO 30. JUNE 1893.
Wrecks near Monomoy Point, Mass.
SCALE
1 ½ 0 1 2 3 STATUTE MILES
Reduced from U.S.C.S. Chart and drawn in office of Captain W.H. Bixby, Corps of Engrs. U.S.A. by P. Brosig 1893.
SHORE LINE
18 FT. CONTOUR AT M.L.W.
WRECKS IN PROGRESS OF REMOVAL AT END OF FISCAL YEAR 1892-3
WRECKS REMOVED DURING FISCAL YEAR 1892-3.
NOTE. DURING FISCAL YEAR 1892-3 THERE HAVE ALSO BEEN REMOVED :
Old Wreck at Edgartown Harbor,
Old Wreck at Nantucket Harbor,
Schooner Franis Edwards at Bedford Harbor,
Schooner Davis Bros. at Dutch Island, Narragan. Bay,
Schooner G.S. Tarbell near Gayhead.
Newport, R.I. July 1893
Respectfully submitted
W. H. Bixby
CAPTAIN OF ENGINEERS
Schooner Bertha J. Fellows
LIFE SAVING STATION
Schooner Nellie V. Rokes
Monomoy Id.
LIGHT
Coal Barge Storm King
ROGERS SHOAL
BEARSES SHOAL
POLLOCK RIP
Schooner J.B. Woodbury
Steam Yacht Alva
Coal Barge Sooloo.
BROKEN PART OF POLLOCK RIP
Barge R.A. Allen
MONOMOY POINT
Stone Schooner
SHOVELFUL LIGHT VESSEL
Schooner Rogers
Sailing Channel
POLLOCK RIP LIGHT VESSEL
HANDKERCHIEF SHOAL
BUTLERS HOLE
TWELVE FEET SHOAL
STONE HORSE SHOAL
BROKEN RIP
HANDKERCHIEF LIGHT VESSEL
Schooner Charlotte Fish.
LITTLE ROUND SHOAL
NANTUCKET SOUND
ATLANTIC OCEAN
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13. WRECK OF STONE SCHOONER AT MONOMOY POINT.

A wooden schooner (name unknown) was in the month of May, 1893, reported as being sunk in 10 to 20 feet depth of water in location approximately 0.7 mile southeast of Monomoy Point, southern Cape Cod, Massachusetts, on the edge of Shovelful Shoal, and as being a dangerous obstruction to the deep and shallow draft steam and sail boat navigation of the neighborhood.

At the time (some years ago) when originally wrecked (by stranding) this vessel was loaded with paving stone, and her measurements were probably approximately as follows: Length, 100 feet; breadth, 30 feet; depth, 9 feet; gross tonnage, 250 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of May 22, and of the Chief of Engineers of May 23, 1893, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the government plant.

The work of her removal is now in progress.

14. WRECK OF SCHOONER NELLIE V. ROKES.

The wooden schooner *Nellie V. Rokes*, was in the month of May, 1893, reported as being sunk in 12 feet depth of water in location approximately 0.5 mile SE. of the Chatham Life-Saving Station, Monomoy, Southern Cape Cod, Mass., and as being a dangerous obstruction to the shallow-draft sailboat navigation of the neighborhood.

At the time (1890) when originally wrecked (by stranding) this vessel was loaded with paving stone and her measurements were approximately as follows: Length, 125 feet; breadth, 32 feet; depth, 9 feet; gross tonnage, 296 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of May 22 and of the Chief of Engineers of May 23, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

The work of her removal is now in progress.

15. WRECK OF SCHOONER ROGERS.

The three-masted wooden schooner *Rogers* was, in the month of June 1893, reported as being sunk in 25 to 30 feet depth of water in location approximately 1.5 miles southwest of Monomoy Point, Southern Cape Cod, in a deep hole of the 12-feet-deep slough across Handkerchief Shoals, and as being a dangerous obstruction to the shallow-draft sailboat navigation of the neighborhood.

At the time (April, 1893) when originally wrecked (by stranding in a snowstorm) this vessel was loaded with coal, and her measurements were approximately as follows: Length, 115 feet; breadth, 31 feet; depth, 9 feet; gross tonnage, 266 tons.

Under the provisions of section 4 of the river and harbor act of June 14, 1880, and by direction of the Secretary of War of June 12 and of the Chief of Engineers of June 13, the destruction and removal of this wreck was authorized, work to be done by hired labor and the use of the Government plant.

The work of her removal is now in progress.

C 22.

PRELIMINARY EXAMINATION OF WOODS HOLL, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Woods Holl, Mass.

This examination was made by Lieut. W. W. Harts, Corps of Engineers, under my orders. His full report is appended. My opinions, as below stated, are based partly on his report and partly upon my own personal knowledge and careful study of this special locality, which was visited by me in person on September 8, 1892, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairmen of the United States Senate Committee of Commerce and of the United States House Committee of Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal.

Woods Holl (see Coast Survey Chart No. 348) is the name given to an important combination of both harbor and waterway on the south coast of Massachusetts opposite the island of Marthas Vineyard and at the end of the point of mainland separating Buzzards Bay from Vineyard Sound. The harbor of Woods Holl is the natural junction of railroad communication from Massachusetts and the north with steamboat communication southward to the adjacent islands of Marthas Vineyard and Nantucket. The waterway of Woods Holl is the natural and most sheltered water communication along the shore from Wareham, New Bedford, and the west, through Buzzards Bay to Vineyard Sound and the east; and, because of its greater shelter, would be much more used by navigation if its passage were better cleared of its rock obstructions. The position of Woods Holl with reference to its own surroundings is very analogous to that of the East River and Hell Gate with reference to the surroundings of New York City and Long Island; and the need of a better channel at Woods Holl is the same as existed in the past at Hell Gate, the main difference being merely in the extent of commerce through the two places.

The adjacent sounds, as well as Woods Holl Harbor, are deep enough to allow of their use by boats of up to 23 feet draft. The majority of vessels that would at present use this passage, draw, however, only from 6 to 10 feet. Prominent among these boats are the steamers plying between New Bedford and Nantucket, carrying hundreds of passengers at a trip during the summer months and passing through this waterway eight times per day. Any accidental meeting of sail and steam boats in this passage must ordinarily result in loss of both life and property (as has already happened in past years).

The present commerce of this waterway is estimated at fully 175,000 passengers and $1,000,000 worth of freight per year. If the channel

were 300 feet wide and 12 feet deep this water would probably be used (on account of the greater shelter of Buzzards Bay route) by at least 5 per cent (2,000 boats, 500,000 tons, or from $5,000,000 to $20,000,000 per year) of the vessels now using the more southern and more exposed route through Vineyard Sound; and the present commerce of this route would thereby be increased at least fivefold, and, moreover, the time and danger of Vineyard and Nantucket Sound travel would be greatly diminished.

In 1874 this waterway was examined by one of my predecessors, Gen. G. K. Warren, and recommended for improvement up to the securing of a channel of 300 feet width and 18 feet depth, this improvement being stated by him to be in his opinion of national character. So far as known to me at present these recommendations have been sustained by all his successors and the Engineer Department from that time until to-day.

The present needs of navigation in this locality, in my opinion, require this passage to be immediately straightened and cleaned out to a width of at least 300 feet and to a depth of at least 12 feet; and such improvement now appears to me to be not only of national importance but at the present time more needed and more worthy of immediate help from the General Government than any other work in this district.

The obstructions in the channel at Woods Holl consist mainly of rock bowlders; and the geological character of this neighborhood being that of glacial deposit, and no ledge rock being in sight anywhere near by, it is reasonable to suppose these rock bowlders to be free from solid ledges and to be removable at reasonable cost.

I have therefore to state my opinion that for the reasons above given this waterway is specially worthy of immediate and extensive improvement by the General Government, and to submit my estimate of $1,200 as an amount that will enable me to make a survey and report, including a project, with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

I am of opinion, for the reasons stated by Capt. Bixby and Lieut. Harts, and from several personal examinations, that the improvement of the channel between Buzzards Bay and Vineyard Sound, near Woods Holl, is eminently worthy of improvement by the General Government; also that the cost of the needful surveys and of the preparation of detailed plans and estimates may fairly be estimated at $1,200.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer Northeast Division.

REPORT OF LIEUT. WILLIAM W. HARTS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., March 17, 1893.

CAPTAIN: I have the honor to submit the following report upon the preliminary examination of Woods Holl, Mass., made in compliance with your verbal instructions of December, 1892:

Information as to this harbor and passage was asked by circular letters sent to persons supposed to be interested in its improvement. To these letters but few replies have been received. The information embodied in the following report was principally obtained from a personal visit to the locality, from inquiries of steamboat captains, and from maps and previous reports. For maps of the water course described and localities referred to in the following, see Coast Survey Charts, Nos. 112 and 348, and p. 368, Annual Report Chief of Engineers for 1880. For a previous report on this locality, see p. 275, Annual Report of the Chief of Engineers for 1874.

Description.—Woods Holl, or Hole, as it was formerly spelled, was originally the name of the narrow and tortuous passage connecting Vineyard Sound and Buzzards Bay, and lying between the mainland and one of the islands of a group that form a chain of about 20 miles in length, extending southwesterly from the southwestern extremity of Cape Cod, Massachusetts. Later this name was also applied to the harbor which adjoins this passage and to the small town located in the near vicinity of both passage and harbor, on the mainland of Massachusetts.

This harbor of Woods Holl consists of two parts, one known as Great Harbor, and another known as Little Harbor, an arm of the former. Great Harbor has a depth of 23-40 feet over the greater part, and may be easily entered from Vineyard Sound by vessels drawing up to 23 feet. Little Harbor, 8-10 feet depth, is principally used by the U. S. Light-House Department. About these harbors has sprung up the town of Woods Holl, of about 500 inhabitants, the southern terminus of a branch of the Old Colony Railroad, a point of transshipment of most of the freight and passengers to and from Nantucket, Marthas Vineyard, and other islands lying to the southward.

In 1853 and 1854 about $2,500 was spent in constructing a breakwater on northern side of Great Harbor to prevent storms from beating into Great Harbor from Buzzards Bay. This amount was insufficient for the purpose, but private enterprise afterward completed the project. In 1879 a small amount of dredging ($4,000 worth of work) was done in Little Harbor to enable the boats of the Light-House Department to reach their docks and repair shops, and in 1883–'84 a masonary dock and basin was constructed in Great Harbor at a cost of $27,000, which construction was built principally for the use of the U. S. Fish Commission: No difficulty in navigating either of these harbors seems to be now encountered by the craft using them and no further improvement there seems necessary at present.

In the passage or Woods Holl, however, much trouble is experienced, and many vessels have been injured on its rocks.

This passage of strait (separating the mainland from Naushon Island, one of the chain of Elizabeth islands) is the most eastern opening from Vineyard Sound into Buzzards Bay and is about 2,500 feet long and 1,600 feet wide. Its channel has several sharp turns and at places is very narrow, being but about 150 feet wide. The bottom and sides are thickly covered with bowlders of various sizes, cemented more or less strongly in a heavy hard clay. No ledge has been found and none is thought to exist. These bowlders have protected the bottom and sides from erosion and prevented a deepening and widening by scour that otherwise most probably would have occurred. The currents here are very swift at certain stages of the tide.

The tide in Vineyard Sound is complex and is the result of two tidal waves, one from the west and another from the east about three to four hours later. This western wave, however, is the only one which affects Buzzards Bay, where, owing to the narrowing shape of the bay, the mean rise and fall on the north side of Woods Holl is about 4 feet, while the mean rise and fall on the other side, in Vineyard Sound, is only about 1.65 feet. High tide in Vineyard Sound is principally the result of the later eastern tidal wave and is therefore from three to four hours later than that of Buzzards Bay. This difference in height and times of high tides on opposite sides of this short passage causes very strong currents of from 4 to 6 knots, with a very short time of slack water.

Commerce.—The extent of the present use of this strait by navigation can not be exactly determined as no record of vessels passing through it has been kept, except in the case of vessels of the New Bedford, Marthas Vineyard and Nantucket Steamboat Company, by which this strait is constantly used. This company owns 5 boats, valued at $200,000 each, making eight trips daily through Woods Holl from June to September and from two to four trips daily during the remainder of the year, and carrying annually 160,000 to 175,000 passengers and about $750,000 worth

of freight. Other steam vessels carrying grain and supplies frequently use this passage, but no record of their number can be found. Larger sailing vessels of 6 to 7 feet draft use this passage at certain stages of tide, but only with an experienced pilot. In the summer season many steam yachts and numerous small sailboats pass through the strait.

One million dollars would probably not be an exaggerated estimate of the annual freight business through this passage.

At the town of Woods Holl but little business is carried on except the transshipment of passengers and freight between the Old Colony Railroad and the steamship line already referred to. This town is a point of distribution for some of the villages of the cape, and its imports are principally coal and lumber, perhaps amounting to $35,000 annually. Its exports are principally fish, annual amount not known, but estimated at not more than $10,000 in value.

Navigation.—The channel in Woods Holl is now buoyed by the Light-House Department. These buoys are often entirely submerged by the swift currents, leaving no reliable guides, and they are likewise sometimes moved from position. The velocity of the tide and the numerous rocks make the passage of this strait a hazardous one, and rather than expose themselves to such risks most vessels would prefer to lose much time and take a longer route. It can easily be seen from inspection of the Coast Survey map what a saving of time and risk a good channel through Woods Holl would make to all vessels bound from New Bedford and from points on Buzzards Bay to eastern ports—Boston, Portland, etc.

There are but few bodies of water of the United States coast that are used as extensively as Vineyard and Nantucket sounds, situated as they are directly in the course of nearly all coastwise vessels between the eastern ports of Maine and Massachusetts and those of New York and States further south. It is estimated that about 40,000 ships pass annually through Vineyard Sound alone. As is well known, this region is much exposed to storms and its navigation at best is more or less hazardous. Any improvement facilitating this navigation, then, would probably be immediately felt by a number of vessels, both by lessening danger and distance and in reducing insurance rates.

Some time could also be saved by coasting vessels by taking advantage of the difference between times of flood tides on the opposite sides of Woods Holl. Thus three hours' longer fair tide could be often found by passing through Woods Holl and sailing up Buzzards Bay than by remaining in Vineyard Sound.

A safe passage here would undoubtedly reduce the number of coasters on the western part of Vineyard Sound and somewhat lessen the dangers of collision, now quite frequent, especially in storms.

Former improvements.—In 1874 Gen. Warren, of the Corps of Engineers, made a favorable report upon the improvement of this strait, recommending several projects, varying in extent and cost. The lowest of these provided for a channel 200 feet wide and 9 feet deep, while the most extensive provided for the entire removal of middle ledge and for channels of 300 feet width and 18 feet depth.

Gen. Warren, in his report of 1874, said: "This improvement may truly be called a national one. It is not for the benefit of the locality It is for a navigable highway uniting two large bodies of navigable water extensively used by the commercial vessels of the United States, and when thoroughly improved it will tend greatly to a saving of time and diminish the dangers of navigation." The need of improvement in this strait is much more urgent now than at the time of Gen. Warren's report.

Based upon Gen. Warren's recommendations, an appropriation was made by Congress in 1878 for improvements at Woods Holl. About $10,000 was expended in work at this strait in 1879, bowlders being removed at Middle Ledge, Devils Foot Island, and Entering Rocks. This improvement, though moderate in cost, has been of great value. These bowlders were raised by a grappling dredge, occasional blasting being resorted to. The conditions of the locality are so disadvantageous that work was necessarily expensive. About 1,000 yards of bowlders were removed. Since this time nothing further has been done by the United States at this place.

Present needs.—The improvement necessary to make this channel more easily navigable is the further removal of certain of the bowlder ledges.

This channel should, in my opinion, be reasonably straight and at least 300 feet wide and at least 12 feet deep at mean low water. At Middle Ledge and Devils Foot Island the channel should be widened and straightened. At Broadway, bowlders should be removed from the sides and bottom, and at Grassy Island and Dry Ledge considerable excavation is necessary. This should satisfy the needs of navigation for some years to come, when, if the increase of commerce should warrant it, the improvement might be continued by further widening and deepening.

On account of the enormous volumes of the tidal prisms of Buzzards Bay and Vineyard Sound, on opposite sides of Woods Holl, and the comparatively large differences in time and height of the tides, it is very unlikely that any reasonable increase in the cross-section of this passage will ever cause much diminution in the

velocity of the currents. But if the improvement of this channel should be made, its passage by vessels would be comparatively easy and safe.

An improvement at Woods Holl would, in addition to helping navigation, doubtless considerably develop the small towns of Buzzards Bay and Vineyard Sound, which towns are now fast growing in importance, and would materially aid all the villages of the cape. From the peculiar nature of the place any improvement at Woods Holl would necessarily be more general than local.

If it is decided to make this improvement, a minor survey will be necessary to more accurately determine the width, depth, and location of the channels and the volume and character of material to be excavated.

Recommendation.—I have therefore to state that in my opinion this waterway is worthy of improvement by the General Government for the reasons above given. It is estimated that from $800 to $1,200 will cover the cost of the further needed survey and report.

Very respectfully, your obedient servant,

WM. W. HARTS,
Second Lieutenant, Corps of Engineers.

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

C 23.

PRELIMINARY EXAMINATION FOR BREAKWATER AT TARPAULIN COVE, NAUSHON ISLAND, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Tarpaulin Cove, Naushon Island, for a breakwater:

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person April 25, 1893. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce and of the United States House Committee on Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal.

Tarpaulin Cove (see Coast Survey chart No. 112) is a semicircular indentation in the south shore of Naushon Island, on the north side of Vineyard Sound, opposite Marthas Vineyard, and about 5 miles west of Woods Holl. It derives its present importance from the fact that it is the only harbor of refuge within 20 or more miles which can be easily reached by small vessels seeking shelter from northeast, north, and northwest storms. Its size is not great, its anchorage area having a frontage of only 1,300 yards with a width or depth of 700 yards for 6-feet draft vessels, 500 yards for 12-feet draft vessels, and 400 yards for 15-feet draft vessels; but its anchorage ground is excellent for holding, and it is therefore much sought and used by small craft during foggy weather and northerly storms.

As a town or commercial port Tarpaulin Cove is of slight importance.

It has a light-house, a post-office, and only a few residences within a radius of 3 or 4 miles, and formerly it was a port of entry; but Naushon Island has no regular communications with the mainland and so no commerce to speak of.

Vineyard Sound, however, is the public highway for all coastwise navigation going from New York (and many other more Southern States) to eastern New England and the North. It is estimated that over 40,000 vessels, of over 20,000,000 tonnage, and carrying from $200,000,000 to $800,000,000 worth of goods, pass annually along this route. In the summer season, from thirty to forty of these vessels are often in sight at once, bound either east or west. This part of the Atlantic Coast is one exposed to severe storms, and the navigation is correspondingly dangerous. Large craft of this neighborhood, are usually provided with very heavy anchors, long anchor chains, and powerful holding gear, strong enough to enable them to ride out a gale in an open roadstead, and therefore their harborage needs are comparatively small; but in storms and fogs the smaller craft must seek shelter. From 1889 to 1892 the number of vessels actually boarded in this harbor by the inspector of customs was about 1,000 per year, of which one-seventh were on their way to or from foreign ports. The light-house keeper has actually counted over 100 of these vessels in this harbor at the same time seeking shelter, and he estimates that the number of such craft lying up there for the night averages 25 to 30 per night in the fall, 10 to 15 per night in the winter, 15 to 20 per night in the spring, and 40 to 50 per night in the summer.

From its situation and shape this harbor is naturally protected against northeast, north, northwest, west, and southwest winds. The winds from the east-northeast to east, from which the harbor has but slight protection, have a full sweep from the Atlantic Ocean. Their effect might be considerably reduced by means of a short breakwater of about 200 yards length on the east side of the cove, extended from the shore outward to 20 feet depth of water.

The winds from the east to south are the most severe, but the island of Marthas Vineyard reduces their sweep so that it is only from 8 to 6 miles. Against these southeast winds this harbor really needs its greatest protection; but, unfortunately, the configuration of the harbor and the conformation of the harbor and sound bottom is such that a protecting breakwater would so narrow the entrance to the harbor and so limit the anchorage area that the utility of the harbor would be greatly lessened thereby. However, danger from these southeast winds is much lessened from the fact that, unless too severe, they are from their direction the most favorable for the navigation of this sound; and vessels can usually use them in seeking shelter elsewhere. The south to south-southwest winds, though only moderately severe and under cover of the island of Marthas Vineyard, still have a sweep of from 6 to 9 miles and roll quite a sea into the harbor. The effect of these south and south-southwest winds might be greatly reduced by means of a second short breakwater of about 300 yards length on the west side of the cove.

The great extent of use of Vineyard Sound as a public highway for through commerce between different parts of the United States, the great value of its shipping and cargoes, the severe storms to which it is at times exposed and the rarity of good shelter, especially for small vessels, all these in my opinion makes this harbor worthy of being improved as far as in my opinion is practicable—*i. e.*, to the extent of the two breakwaters above recommended. Should future developments ap-

pear to justify still further protection, it can be secured at any time by the simple extension of that herewith suggested.

I have therefore to state my opinion that for the reasons above given this waterway is worthy of improvement by the General Government, and to submit my estimate of $1,000 as an amount that will enable me to make a survey and report, including a project, with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. A.

I concur with the local officer, for the reasons stated, in considering Tarpaulin Cove to be worthy of improvement by the General Government; also that a suitable survey and the preparation of the project will cost $1,000.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

C 24.

PRELIMINARY EXAMINATION OF NEW BEDFORD HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of New Bedford Harbor, Massachusetts.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person September 7, 1892, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce, and of the United States House Committee on Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties, and to contribute such information and assistance as was at their disposal.

New Bedford Harbor (see Coast Survey Chart No. 350) is a well

land-locked estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fairhaven, Mass. The two cities together have a population of about 38,000 (1888 census), having increased 50 per cent since 1874. New Bedford is an important port of entry, its revenue collections being about $80,000 annually.

The present water commerce of this harbor is reported at about 490,000 tons ($3,800,000) per year; the gain since 1874 having been about 100 per cent. The reported entrance and departure of boats of all kinds now amount to about 10,000 per year.

This harbor has been since 1874, and is still now, under improvement by the General Government, during which time $13,000 has been spent toward securing a depth of 18 feet in the channel leading from Buzzards Bay into the harbor and up to opposite the city. Some work still remains to be done to complete the already approved projects for this harbor, but such work is already provided for by such past projects.

To-day it appears desirable that more anchorage room should be provided for within the harbor itself for the numerous heavy-draft vessels that can now reach the city. This can be provided for by dredging to 18 feet depth within the inner harbor on one or both sides of the present channel. The harbor limits will allow of this anchorage being extended in time to an area of 800 yards square, but it appears to me that an anchorage area of 700 yards length by 200 yards breadth and of 18 feet depth, added to one side of the present 200 feet wide channel, should be sufficient for the needs of the harbor for the present and for several years to come.

The steady increase in the use of this harbor during recent years, considered in connection with the present amount of its commerce, and the fact that this commerce is mainly one with neighboring States (and therefore not merely a local one), all these are regarded by me as excellent reasons for further improvement by the General Government.

I have, therefore, to state my opinion that for the reasons above given, this harbor is well worthy of further improvement by the General Government, and to submit my estimate of $1,000 as an amount that will enable me to make a survey and report, including a project, with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

I am of opinion, for the reasons set forth by the local engineer, that this harbor is worthy of improvement by the General Government to the extent of increasing the anchorage area by a length of about 700 yards and a width of about 200 yards, to a depth of 18 feet; the same to be located on one side of the present 200-foot channel; also that the cost of the needful survey and preparation of plans and estimates for said improvement should not exceed $500.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen. U. S. A.,
Engineer Northeast Division.

C 25.

PRELIMINARY EXAMINATION OF PAWTUXET HARBOR, PROVIDENCE RIVER, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Pawtuxet Harbor, Providence River, Rhode Island.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person March 15, 1893. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce, and of the United States House Committee on Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties, and to contribute such information and assistance as was at their disposal. In answer to my letters very few replies and very little definite information were received, showing that the demand for this improvement was not a general one.

Pawtuxet Harbor (see Coast Survey Chart No. 113) is the enlarged outlet of the Pawtuxet River, and is located on the west side of the Providence River, about 5 miles south of the center of the city of Providence.

The Pawtuxet River, entering the harbor at its upper end, is completely closed by a water-power dam about 400 feet from the harbor; and is therefore of no importance as regards questions of navigation, The harbor itself is of very small size, being of about 2,000 feet length, 400 feet breadth, and of about 4 feet average depth, with a bar entrance carrying only about 1 foot depth at low water. The distance from the harbor entrance to the nearest deep water in the Providence River is from 2,000 to 3,000 feet, and any improvement of the harbor would necessarily include the dredging of this channel entrance. As a village Pawtuxet Harbor is merely a residential suburb of Providence, and comprises a few hundred houses, and has no large manufactories and no commerce other than that needed to supply the necessaries of life to its own population of about 1,000 persons. Its interests are extremely local in their nature, and concern merely itself and the adjoining city and towns. The local surroundings are such that even were this harbor improved to its utmost capabilities its commerce for many years would be naturally restricted to the 5 miles distance between itself and the city of Providence, and would not affect to any appreciable extent even the rest of its own State, and much less other of the United States. Its improvement would undoubtedly be of great local benefit, but its cost ought, in my opinion, to be paid for by those most immediately interested, and not by outsiders.

I have therefore to state my opinion that for the reasons above

given this harbor at present is decidedly *not* worthy of improvement by the General Government.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local engineer, I am of opinion that this harbor is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer Northeast Division.

C 26.

PRELIMINARY EXAMINATION OF APPONAUG HARBOR, COWESSET BAY, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Apponaug Harbor, Cowesset Bay, Rhode Island.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person March 15, 1893, and at several times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce, and of the United States House Committee on Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal. In answer to my letters, very few replies were received, showing that the demand for this improvement was not a general one.

Apponaug Harbor (see Coast-Survey Charts Nos. 113 and 351) is located at the northwest corner of Greenwich Bay, on the west side of Narragansett Bay, about 10 miles south of Providence. Apponaug itself is a small village in the town of Warwick, and has a population of only about 1,000 persons, without any special manufactories or commerce. Its harbor, the enlarged mouth of a small stream called Appo-

naug River, is a cove or estuary of about 1,800 yards length, from 100 to 400 yards breadth, with a channel of about 3 feet general depth at low water (7 feet at high water). Where the mouth of this cove connects with Greenwich Bay the depth is 7 feet at low water. The apparent desires of the people of Apponaug are for the dredging of a channel of 7 to 10 feet depth, and 30 to 100 yards width from Greenwich Bay up to the village wharves.

At present Apponaug has no special commerce. In former days considerable coal and baled cotton was brought in 8 to 12 feet draft boats through Greenwich Bay up to wharves at Greenwich Harbor, about 3 miles from Apponaug center, or to those at Cowesset, about 1.5 miles from Apponaug center, thence carted to Apponaug and thence from 3 to 7 miles farther to cotton mills in the western part of the town of Warwick. At other times these vessels lay at anchor in Greenwich Bay and their cargo was carried to Apponaug on shallow lighters. But these cotton mills now obtain their supplies by rail from Providence, this latter place being now accessible to boats drawing 25 feet at low water. The mills altogether constitute a large and important industry, and add greatly to the wealth and commerce of Rhode Island. Their imports in the way of raw materials amount to over $4,000,000 (mostly coal and cotton, brought by water), andtheir exports amount to over $8,000,000 (mostly manufactured cloths, sent off by rail). To-day these mills are tributary to Providence, from which they are only from 10 to 15 miles distant by railroad. Their commerce therefore forms an important element of that of Providence, and as such has already received great assistance from the General Government in its past liberal appropriations for the improvement of Providence River to 25 feet depth. The people interested in the improvement of Apponaug Harbor hope to secure soon a short line of railroad (not yet built) from the mill region to their harbor; and then, if they can secure the improvement of their harbor, they can divert to this harbor a large portion of the present commerce of Providence. The adjacent and rival town of Greenwich hopes in a similar way to secure these advantages to itself. This arrangement would at the most save to through freight from other States or foreign ports only about 10 miles of water transportation and only about 7 miles of rail transportation, and would not avoid the necessity of transshipment from boat to cars nor the necessity of some rail transportation. Under such circumstances, the diversion of this commerce from Providence to Apponaug or Greenwich would not affect to any great extent the total cost of freight and handling, could therefore concern but little other States, or even the State of Rhode Island itself as a whole, and can not be expected to specially develop any really new commerce. It appears to me, therefore, that such an improvement is of local and not general interest, and should therefore, if made, be paid for by those locally interested, and not by other States of the Union.

I have therefore to state my opinion that for the reasons above given this harbor is *not* at present worthy of improvement by the General Government.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local engineer, I am of the opinion that this harbor is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer Northeast Division.

C 27.

PRELIMINARY EXAMINATION OF GREENWICH HARBOR, GREENWICH BAY, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Greenwich Harbor, Greenwich Bay, Rhode Island.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person March 15, 1893, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce, and of the United States House Committee on Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal. In answer to my letters, very few replies were received, showing that the demand for this improvement was not a general one.

Greenwich Harbor (see Coast Survey Charts Nos. 113 and 351), is located at the southwest corner of Greenwich Bay, on the west side of Narragansett Bay, about 13 miles south of Providence. The town of Greenwich is a place of about 4,000 inhabitants, of which about 3,000 live in the village of East Greenwich adjacent to the harbor. Greenwich has no great commerce nor many large manufactories; being to a great extent a residental town, many of whose leading citizens do business in Providence. The harbor itself is a cove or small estuary of about 2,500 yards length, 300 yards width, and with a channel of about 10 feet depth at low water (14 feet at high water) over half its length, and 8 feet depth along its wharf front. The apparent desires of the people interested in this improvement are for the dredging of a channel of 13 feet depth along its wharf frontage and from the mouth of the harbor out into the middle of the bay, a total length of dredging of about a mile and a quarter.

At present, Greenwich Harbor has very little commerce. In spite of the fact that vessels of 10 to 12 feet draft can easily reach its wharves, the water commerce of 1891 was reported as only $100,000, mainly coal and lumber, almost all brought in two sailboats, each making weekly

or fortnightly trips. Evidently the facilities of the harbor are already far in advance of the actual needs of the present water commerce. In former days large quantities of coal and baled cotton was brought to this harbor and thence carted from 5 to 9 miles to cotton mills in the western part of the adjoining town, Warwick. But these cotton mills now obtain their supplies by rail from Providence, this latter place being now accessible to boats of 25 feet draft. These mills altogether constitute a large and important industry, and add greatly to the wealth and commerce of Rhode Island. Their imports in the way of raw materials amount to over $4,000,000 (mostly coal and cotton, brought by water) and their exports amount to over $8,000,000 (mostly manufactured cloths, sent off by rail). To-day these mills are tributary to Providence, from which they are only from 10 to 15 miles distant by railroad. Their commerce therefore forms an important element of that of Providence, and as such has already received great assistance from the General Government in its past liberal appropriations for the improvement of Providence River to 25 feet depth. The people interested in the improvement of Greenwich Harbor hope to secure very soon a short line of railroad (not yet built) from the mill region to their harbor; and then, if they can secure the improvement of their harbor, they can divert to this harbor a large portion of the present commerce of Providence. The adjacent rival village of Apponaug hopes in a similar way to secure these advantages to itself. This arrangement would at the most save to through freight from other States or foreign ports only about 10 miles of water transportation and only about 7 miles of rail transportation, and would not avoid the necessity of transhipment from boat to cars nor the necessity of some rail transportation. Under such circumstances the diversion of this commerce from Providence to Greenwich or Apponaug would not affect to any great extent the total cost of freight and handling, could therefore concern but little other States, or even the State of Rhode Island itself as a whole, and can not be expected to specially develop any really new commerce. It appears to me, therefore, that such an improvement is of local and not general interest, and should therefore, if made, be paid for by those locally interested, and not by other States of the Union.

I have, therefore, to state my opinion that for the reasons above given this harbor is not at present worthy of improvement by the General Government.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local engineer I am of opinion that this harbor is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer Northeast Division.

C 28.

PRELIMINARY EXAMINATION OF WICKFORD HARBOR, NARRAGANSETT BAY, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 10, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Wickford Harbor, Narragansett Bay, Rhode Island.

This examination was made by Lieut. W. W. Harts, Corps of Engineers, under my orders. His full report is appended. My opinions, as below stated, are based partly on his report, and partly upon my own personal knowledge and careful study of this special locality, which was visited by me in person September 19, 1892, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee of Commerce and of the United States House Committee of Rivers and Harbors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal.

Wickford Harbor (see Coast Survey Chart No. 113) is the name of a small harbor on the west side of Narragansett Bay about 18 miles south of Providence. It is also the name of the terminus of a short branch of the Shore Line (New York, New Haven and Old Colony) Railroad, whose steamboat connection at this point carries a through travel and mail from New York to Newport, R. I. A very short distance from the railroad wharf is the small town of Wickford (population about 4,000) whose importance is now mainly due to its cotton and woolen manufactories. The improvement of the harbor would benefit both the through travel and the local commerce.

At present this harbor has an available depth of only about 9 feet at low water, and is used only by the Newport and Wickford steamboat and by sailboats of from 4 to 12 feet draft and of about 200 tons burden. The total commerce of the town and harbor, both by land and water, is from $2,000,000 to $3,000,000; and it is claimed that its transportation rates are all dependent to a large degree upon the existence and condition of the harbor and its distance from Providence, the nearest port of greater depth. The present water commerce, however, is only about $300,000 (mainly coal imports), though it is claimed that this might be doubled or trebled if the available depth of the harbor were increased to 12 feet at low water (16 feet at high water).

In 1873 this harbor was recommended by one of my predecessors, General Warren, for improvement by the General Government to 9 feet depth, for the commencement of which $10,000 was afterwards appropriated by Congress. This $10,000 was employed advantageously in improving the channel up to the railroad wharf. The present desires of the town are apparently for further improvement so as to extend a greater depth up not only to the railroad wharf but also up to the town beyond. Such improvement would need a channel of from 150 feet to 200 feet width and of 12 feet depth at low water; which could

be dredged at this place at reasonable cost, and which would undoubtedly do much to develop an increased commerce between Wickford and other towns in other States, as well as to be of advantage to the through travel and commerce between New York and Newport. Past experience indicates that dredging at this place will prove reasonably permanent.

Owing to the comparatively small development of its water commerce during past years, in spite of the fairly good water facilities which it already possessed, this harbor appears to me to be one of that class whose claims upon the General Government are of doubtful strength; yet, in view of the combination of its through travel with its own commerce and business, its distance from other better ports, the fact that its imports are mainly from other States, and the reasonably small cost of the desired improvement, I am willing to allow its claims rather than to disallow them.

I have, therefore, to state my opinion that, for the reasons above given, this harbor is worthy of moderate improvement by the General Government; and to submit my estimate of $1,000 as an amount that will enable me to make a survey and report, including a project, with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 14, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

After carefully considering the reports of Capt. Bixby and Lieut. Harts, I am of opinion that no reasons are presented which demonstrate that this harbor is worthy of improvement by the General Government to the extent proposed, viz, of increasing its depth to 12 feet and extending it above the railroad wharf to the bridge. In view, however, of the facts that the transit route to Newport is of no little importance to the public, that the original project was not completed, and that the existing channel, although "good" is "narrow and not straight," it would seem that a new survey may be needed to determine whether this channel, at its present depth (9 feet at low water), may not be worthy of further widening and improvement by the General Government; and I therefore recommend that such a survey, not to exceed $200 in cost, be made.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A., Div. Engineer.

REPORT OF LIEUT. WILLIAM W. HARTS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 15, 1893.

CAPTAIN: In accordance with your verbal instructions of December, 1892, I have the honor to submit the following report upon the preliminary examination of Wickford Harbor, Rhode Island, with a view to its improvement by the General Government.

Information as to this harbor was asked by circular letters sent to persons supposed to be interested in its improvement. To these letters only a few replies have been received. The information embodied in the following report was principally obtained from a personal visit to the locality, from inquiries of steamboat captains, and residents of Wickford, and from maps and previous reports. For maps of this harbor see Coast Survey Chart No. 357. For a previous report upon this harbor see p. 972, Annual Report of Chief of Engineers for 1873.

Description.—Wickford harbor is located in the western part of Narragansett Bay, Rhode Island, almost due west of the northern end of Conanicut Island, and is an arm of Narragansett Bay. Its entrance is about one-fourth of a mile wide, spreading into several branches—two to the north and one to the south. The two northern branches, Mill Cove and Fishing Cove, are but seldom used, the land in the near vicinity being as yet unimproved. There is a fairly good channel of about 6 feet to 8 feet depth at low water into Mill Cove as far north as Rabbit Island, but the remainder of this branch and nearly all of Fishing Cove are very shallow, having but 2 to 4 feet depth at low water. Except for fishing these two northern branches are so little used at present that no improvement by the General Government seems now necessary. The southern branch, known as Wickford Cove, extends about three-fourths of a mile southerly from the entrance to the harbor, and is there closed by bridges. The northern end of this branch, where it joins the other branches, is very narrow. At this northern end, between the railroad docks and Baker's Dock, the width is about 400 feet, increasing to the south to a considerably greater width of about 1,300 feet. The town of Wickford is located in the near vicinity of this southern branch, and all of the water commerce of the town is landed at docks on this branch. It is here where improvement of the facilities of navigation is desired. There is now a good 9-foot channel at low water from the deep water of Narragansett Bay up to the steamboat and Baker's Wharves, but it is narrow and not straight. From these wharves there is a fairly good channel of 6 feet depth at low water up to the bridges. Docks have been built out to this channel, and barges are towed to these docks at high water to unload. The mean tide rise is a little over 4 feet.

The approach to this harbor has a number of rocks in more or less dangerous positions, which render the navigation in this locality quite hazardous in the frequent fogs. Old Gay Rock, rising above the water just south of the entrance, was for a long time a troublesome obstruction, but as it is now marked by a bell and light it is rather a help than a hindrance. Charles Rock, surrounded by about 7.5 feet depth of water, but carrying only about 3.5 feet depth, is directly across the channel to the north, and is a source of considerable anxiety to pilots. The channel width between these rocks is only about 700 feet. At present Charles Rock is marked by a spar buoy only. In the channel between Gay Rock and Charles Rock is Van Buren Rock, dredged to 9 feet depth in 1874. About one mile further to the east there is a scattering cluster of rocks, through which a passage is marked by buoys. This passage is occasionally used, and is nearly always open when the regular channel is blockaded with ice. This cluster of rocks extends from the shore to the southward, and ends in a rock known as James Ledge. This rock, marked by a buoy, and lying in the direct line from the north end of Conanicut Island to Wickford Harbor, lies in the course of vessels from Newport Harbor to Wickford, and is also entirely submerged. To the south of James Ledge there is ample width and depth of channel (a mile in width and 20 to 25 feet in depth) as far south as Fox Island.

The town of Wickford has now about 4,000 population and has for upwards of fifty years been the location of cotton and woolen industries. In a manufacturing way Wickford is very energetic, having operated for many years a number of fair-sized woolen and cotton mills. There are at present seven of these mills in the near vicinity of this village. In 1871 there was established a passenger and freight line between Newport and Wickford Junction running by steamer from Newport to Wickford Landing and thence by rail to Wickford Junction, connecting with the shore line for New York. This route is an active competitor for the freight and passenger traffic of Newport, which in the summer season is of considerable importance. This route has developed the town of Wickford and placed new demands upon its harbor.

Commerce.—The cotton and woolen mills put out annually about one and three-quarter million dollars worth of manufactured goods, most of which are now shipped by rail. The cotton goods and fish are the principal exports, the imports being principally provisions, building supplies, and raw materials. The following estimate of the amount of business done in 1892 in Wickford is based upon a report kindly furnished by Mr. S. H. Vaughn, of Wickford.

Imports.

Lime and cement, 800 barrels, at 75 cents	$600
Grain, 105,000 bushels, at 30 cents	31,500
Flour, 4,375 barrels, at $4	17,500

Hay, 250 tons, at $10	$2,500
Oil, 1,000 barrels, at $3	3,000
Coal, 40,272 tons, at $4	161,088
Wood, 500 cords, at $2	1,000
Machinery, 250 tons, at $100	25,000
Sugar, 950 barrels, at $15	14,250
Mill feeds, 500 tons, at $5	2,500
Shucks, 126 tons, at $5	630
Drugs and chemicals, 80 tons, at $50	4,000
Merchandise, 4,355 tons, at $10	43,550
Wool, 683 tons, at $500	341,500
Cotton, 607 tons, at $200	121,400
	873,018

Exports.

Oysters, 14,000 bushels at $1.50	$21,000
Clams, 6,000 bushels at $2	12,000
Scollops, 5,000 galls at 50 cents	2,500
Fish, 450 tons at $100	45,000
Cotton and manufactured goods	1,750,226
	1,830,726
Total exports and imports	$2,703,744
Increase in machinery during 1892	100,000

Mr. Vaughn also reports that the harbor was used in 1892 approximately as follows:

	Times.
By steam vessels freight and passenger, 4 to 12 feet draft	3,850
By steam vessels passenger mainly, 4 to 8 feet draft	2,160
By steam vessels pleasure	4,480
By sailboats, freight, 4 to 12 feet draft, average tonnage 200 tons	438
By sailboats, pleasure, large and small	13,880

The Wickford line steamer *Tockwogh* makes eight trips per day in winter and ten trips in summer.

From these statements, it appears that the total of exports and imports (excluding the traffic of the Wickford line, which could not be obtained) is about $2,750,000 for 1892, and that during the past year the facilities for production have been increased by about $100,000.

The manufactured goods which form a large part of the exports will probably never be shipped by water on account of their value and liability to damage. The imports and the fish exports are the only freight articles that can be well carried by water, and of these about 25 per cent is now transported in vessels. Of the total commerce probably not more than $300,000 in value was transported by water. It is claimed by those interested that a further improvement of this harbor will at least treble this amount of water commerce.

Navigation.—Wickford Harbor is in a quiet part of Narragansett Bay where navigation is never very difficult except on account of fogs. Several vessels have struck rocks in this harbor and have been badly injured during some of these fogs. The small depths within the harbor prevent its use by vessels drawing more than about 10 feet, and these can only enter at high tide. Much delay is thus caused by waiting for tides, etc., compelling some of the large coal and freight vessels to seek better ports. There has been a steady increase during late years in the size and draft of coal and freight vessels, which increase has not been followed by a similar improvement of the channels at Wickford, thus making this village more and more dependent on the single railroad, whose rates, though not excessive, are high.

The size of the harbor, the nature of the bottom, and comparative cheapness of dredging, make the improvement of this harbor to meet the needs of commerce for some years to come, comparatively simple and cheap.

Former improvements.—This harbor was examined and surveyed under direction of General Warren of the United States Corps of Engineers in 1872 (see Report of Chief of Engineers for 1873, p. 972). General Warren, in his report, recommended the improvement of this harbor and proposed a project for dredging the channel to 9 feet depth near the entrance of the harbor, for the removal of Van Burens Rock and James Ledge. Based upon this report, an appropriation of $5,000 was made by Congress in 1873 for improvements at this place. The work of widening and deepening the channel at the entrance of the harbor by dredging, and the removal of obstructing bowlders was carried on during 1873–'74. The next year Congress again appro-

priated $5,000 for the continuation of the improvement of this place. These improvements were not carried farther inward than the steamboat wharf. They completed from the bay as far as the steamboat wharf a fairly good channel with a depth of 9 feet at mean low water. General Warren's project was never completed, but the improvement then made was a great benefit to the commerce at the time. The condition of this channel is probably but little changed since its improvement except that some slight shoaling is found in the vicinity of the steamboat wharf.

Present needs.—This harbor to meet the present needs of commerce should have a clear channel from the bay to head of navigation opposite the village docks near the roadway bridges, of at least 12 feet in depth at low water and at least 150 feet wide and as straight as reasonably possible. This would require dredging in Wickford Cove, the further removal of Van Burens Rock, and perhaps the removal of a portion of Charles Rock, all to 12 feet depth. It is not thought necessary to remove James Ledge, but a conspicuous beacon or other better mark for this place would be of great assistance to navigation. In case the improvement is decided upon, a careful hydrographic survey to determine the character and limits of the excavation should be made. Such survey might cost from $500 to $1,000.

Recommendations.—In my opinion this harbor is worthy of improvement by the General Government, and I have therefore to recommend a careful survey at an expense of not over $1,000 to determine the nature, amount, limit, and character of excavation necessary.

Respectfully submitted,

WM. W. HARTS,
Second Lieutenant, Corps of Engineers.

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

C 29.

PRELIMINARY EXAMINATION OF INNER HARBOR AT POINT JUDITH BREAKWATER, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 12, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Inner Harbor at Point Judith Breakwater, Rhode Island.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person September 17, 1892, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee of Commerce, and of the United States House Committee of Rivers and Harbors, to the United States Senators and Representatives in whose States and districts the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties, and to contribute such information and assistance as was at their disposal.

Point Judith is a low rocky projection of land in the town of Kingston, at the southwestern corner of Narragansett Bay, where it connects with Block Island Sound. This point is exposed to the full force of southeast gales coming from the ocean, and the severity of these gales is evident from the fact that eighteen schooners were wrecked near this point in the six years from 1883 to 1888 inclusive. As over 40,000 vessels (carrying over 20,000,000 tons, or from $200,000,000 to $800,-

000,000 worth of cargo) annually pass this point on their way from New York and the South to Rhode Island and the North, a breakwater has been planned and provided for by Congressional appropriations to serve as a national harbor of refuge for vessels seeking shelter in this neighborhood. This breakwater is estimated to cost about $1,000,000, and a full contract has been made for its completion. It is now expected that the funds will be forthcoming at the rate of about $100,000 per year, so that this breakwater will be finished in about ten years.

Behind the proposed breakwater, about a mile west of the point, is a large salt pond called Point Judith Pond. This pond is triangular in general shape, and about 1.25 miles broad at its ocean base, and about 4 miles long from base to its apex, near Wakefield. The entire area of the pond is approximately 1,800 acres, of which less than 600 is of over 6 deet depth, and less than 150 acres is over 10 feet depth (these deeper parts being as usual in the shape of long narrow strips mainly in the middle portions of the pond) and of which only a few spots for short distances near its upper end in the mid-channel are of as much as 15 feet depth. The low-water level of the pond is about 2.5 feet above that of the ocean; so that if the pond were opened freely to the ocean, the low-water area of the pond, as well as that of its 6 and 10 feet depths, would be much diminished. The pond is separated at present from the ocean by a sand beach of from 1,000 to 3,600 feet width at high water, through which at the western corner of the pond there is at present a slough of about 300 feet width at high water with a depth so slight as to be regularly forded at low water by ox teams loaded with seaweed. The beach is of fine sand at its western end, the sand apparently slowly moving westward under a slight local littoral ocean current. The beach is of coarser sand at its middle, this sand being apparently cast up from the foreshore ocean bottom by wave action. The beach is of gravel and pebble and rock at its eastern end, with rarely any trace of sand. Near the eastern corner of the pond and eastern end of the beach is the place where the entrance to the pond existed in olden days; this entrance having been closed and filled solid with sand and pebbles for a thousand feet back, by a single but excessively severe storm a great many years ago. After the old entrance was closed the water in the pond gradually rose and finally cut a new outlet much further to the west, near the location of the present entrance. It is this pond which the persons of the neighborhood apparently desire to be converted into an "inner harbor of refuge at Point Judith Breakwater," partly for the benefit of vessels expected in future to seek shelter behind the breakwater, and partly for the direct benefit of the villages of Wakefield and Peacedale, near the head of the pond, and of the other parts of the towns of South Kingston and Narragansett.

The location of the old entrance to this pond is in comparatively solid ground, and where there is at present, apparently, no moving sand on the ocean beach, so that a new entrance at this point would probably remain open until closed again, as before, by some unusually severe storm. The people of the locality imagine that such closure will not happen again, but I can see no special reason for future exemption from occasional storms equal to those of the past, and no consequent safety for the entrance until after it is protected by the ocean breakwater now under construction, a breakwater that will be directly in front of this entrance, but, however, one that will probably not be completed before 1903. Supposing, however, that this ocean breakwater were completed, the new entrance would even then need a local protection for its entrance in the shape of two small jetties, and a channel would have to

be dredged through the sand beach itself and a long ways further to the location of the deepest water in the pond, or, perhaps, to Wakefield. The portion next the ocean will then probably have to be doubled in width or revetted to prevent constant caving and redredging. By this time the pond level will have been somewhat lowered, and the channel will have to be deepened somewhat. The mere first cost of such improvement will be very expensive, and its after cost for maintenance will probably be quite considerable for several years.

The conditions of the locality are such that no improvement of this place will be of any special utility to the United States unless it provides for at least 10 feet depth of entrance channel and a fairly large interior harborage of the same depth.

The towns of South Kingstown (including Wakefield and Peacedale), together with the town of Narragansett (including the summer watering place of Narragansett Pier) have a total population of only about 7,000 persons, with an average gain of only about 120 per year. The total real estate value of these two towns (according to the official State Manual) is only about $7,000,000, of which half is that of the noncommercial summer residential property of Narragansett Pier. Their fisheries were formerly from $15,000 to $30,000 per year; but since the closure of the old inlet these have diminished to about $3,000 per year. Their manufactories are mainly of cloth goods. Their imports (see attached statement of Mr. B. F. Robinson) are estimated at about $2,500,000, of which about half is lumber, and about one-sixth is wool. Their exports are mainly such manufactured products as it would not be advisable to send off by water transportation. The total saving in freights which would result to this neighborhood from everything being sent off by water is estimated at about $30,000 per year. Of this amount probably one-tenth, $3,000 per year, would be the saving to the rest of the United States, and would represent their interest in this improvement. The need of any improvement at this place is much lessened by the fact that two fine 25-foot depth harbors are within 30 miles distance, Providence to the north, and New London to the west.

I have, therefore, to state my opinion that, for the reasons above given, the inner harbor of refuge at Point Judith Breakwater, Rhode Island, is decidedly not at present worthy of improvement by the General Government.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, northeast division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 15, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local officer I regard the inner harbor of Point Judith Breakwater as wholly unworthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer Northeast Division.

A.—COMMERCIAL STATISTICS OF TOWN OF SOUTH KINGSTOWN, POINT JUDITH INNER HARBOR, RHODE ISLAND, DURING YEAR 1891.

Taxed valuation town of South Kingstown, $10,000,000; population, 6,230; passengers, Narragansett Pier R. R., 65,000; stores—grain, merchandise, 50; hotels, 20; passengers carried by steamer from Narragansett Pier and Newport, 10,000.

Domestic imports.

Quantity.	Articles.	Value.	Railroad freights.	Water freights.	Railroad in excess of water freights.
6,000,000	Lumber.....feet..	$1,258,000	$2.50 per M ...	$1.50 per M ...	$6,000.00
4,600,000	Shingles.....	160,000	2.50 per M ...	1.50 per M ...	4,600.00
750,000	Brick.....	65,000	1.75 per M ...	.90 per M ...	637.50
10,000	Coal.....tons..	57,000	1.75 per ton ..	.75 per ton ..	10,000.00
500	Super phosphate.....tons..	25,000	2.00 per ton ..	1.00 per ton..	500.00
2,000	Cement.....barrels..	2,500	.24 per bbl..	.12 per bbl..	240.00
2,000	Lime.....barrels..	2,500	.24 per bbl..	.12 per bbl ..	240.00
300	Hay and straw.....tons..	3,000	2.00 per ton..	1.00 per ton ..	300.00
100	Nails and hardware.....tons..	10,000	2.00 per ton..	1.00 per ton ..	100.00
125,000	Grain.....bushels..	65,000	.06½ per bus.	.03 per bus..	4,375.00
500	Wood.....cord..	2,700	1.00 per cord .	.80 per cord.	100.00
20,000	Miscellaneous merchandise, tons.	430,000	2.00 per ton..	1.00 per ton ..	2,000.00
1,175,000	Wool.....pounds..	411,250	2.50 per ton..	1.50 per ton..	587.50
	Total.....	2,491,950			29,689.00

Domestic exports.

Woolen manufactures	$800,000
Farm products	200,000

On which would be a proportionately large saving if water transportation was available.

If this harbor was provided, from the results as above stated, the excess of railroad freights above water freights being $29,680, that amount will be saved per annum. This at 5 per cent per annum will warrant an expenditure of $593,600 (for twenty years' benefit alone) to construct the inner harbor.

B. F. ROBINSON,
President Wakefield Trust Company.

SEPTEMBER 2, 1892.

C 30.

PRELIMINARY EXAMINATION OF BREACHWAY INTO SALT POND, BLOCK ISLAND, RHODE ISLAND.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., June 12, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of breachway into Salt Pond, Block Island, Rhode Island.

My opinions, as below stated, are based upon my own personal knowledge and careful study of this special locality, which was visited by me in person September 7, 1892, and at several other times during the past year. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee on Commerce and of the United States House Committee on Rivers and Har-

bors, to the United States Senators and Representatives in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal.

Block Island (see Coast Survey Chart No. 113 and No. 356) is an island of about 5 miles length and averaging about 2 miles breadth, its longest dimension running north and south, with a population of only 1,300, and a real estate valuation (official State list) of only about $750,000. It is about 15 miles northeast of Montauk Point and the eastern end of Long Island, about 20 miles southeast from Stonington and the eastern end of Long Island Sound, about 12 miles south of Point Judith and the southern shore of the mainland of Rhode Island, about 20 miles south-southwest of Newport and the entrance to Narragansett Bay, and about 40 miles west-southwest of Marthas Vineyard and the entrance to Vineyard Sound. It is surrounded by deep water, 60 feet depth being found within 1,000 yards of its west shore and within 2,000 yards of its east shore. It is, of course, exposed to the full violence of the winds and storms coming from the Atlantic, getting no protection from any adjacent land. Its prevailing winds, arranged in order of prevalence (according to the Signal Service reports for many past years) are first, southwest, then northwest, northeast, and north. Its storm winds, arranged in order of severity (same authority), are first, northeast, then southwest, northwest, and southeast. Of these the northeast, north, and northwest come from the direction of the mainland (the northeast wind through Buzzards Bay with a sweep of about 50 miles, but the north and northwest winds from Rhode Island, with a sweep of only from 12 to 15 miles), while the southwest and southeast winds come in from the Atlantic with practically unlimited sweep.

The advanced position of this island has always made it an important rendezvous for fishing boats and pilot boats which naturally seek to remain out as far as possible toward the ocean. When storms come up suddenly these boats must seek immediate shelter, and their attempt to get this at Block Island has always resulted in numerous shipwrecks. Between 1854 and 1868 these wrecks averaged three per year, the average loss (vessel with cargo) being about $7,000 per vessel; and from 1883 to 1892 these wrecks averaged six per year, the average loss (vessel with cargo) being, however, only about $3,000 per vessel, showing that, as a rule, these wrecked vessels were all small, comparatively speaking. In order to give a better shelter to such craft about $300,000 was appropriated by the General Government between 1870 and 1892 for the construction of a breakwater of about 2,000 feet length with an inclosed harbor about 900 feet square. The breakwater was finished in 1888, and the inclosed harbor will probably be completed during the present year. As a result the departures from this harbor now average 4 steamers, 16 large fishing boats, and over 100 small pleasure boats per day all the year round, and the commerce has increased since 1868 from about $300,000 to over $800,000 per year. Although the number of wrecks per year has increased since the existence of the breakwater, this is to a great extent due to the increase in the number of boats using the harbor, and the total loss by wrecks on this island (omitting what has been saved from the wreck) is now (Appendix E) much less than before, and will undoubtedly be still less after the work of this year is finished and the harbor is closed in.

As to the future development of the commerce of this island, its insular position and limited size must necessarily prevent the island or town from ever becoming a large seaport like Providence or even Newport or Stonington.

But Block Island, from its advanced position is where it is daily passed by large numbers of vessels, either coastwise bound from New York and the South to Rhode Island and Massachusetts, and the North, or else from foreign countries direct to Connecticut (through the east end of Long Island Sound), and to Rhode Island (through Narragansett Bay). This commerce is large and entitled to great consideration. About 150 vessels per year pass this island on their way from foreign ports to Providence; a few in like manner on their way to other harbors of Narragansett Bay; a few direct to Long Island Sound, and a few direct to Vineyard Sound. But the mass of the vessels, over 40,000 per year, go past Block Island on their way along the great highway of coastwise travel through Long Island Sound, Block Island Sound, and Vineyard Sound, passing north of Block Island, halfway between the island and Point Judith; and for the further safety of this travel in bad weather the General Government has just pledged $1,000,000 for a breakwater and national harbor of refuge at Point Judith, a work already under construction.

The salt pond of Block Island is a large pond of brackish water lying about midway of the island. Its position and surroundings are such as to lead some people to suppose that Block Island was originally two or more separate islands, that this pond was originally a part of the ocean separating these islands, and that storms, waves, and shore currents afterwards built up two sand beaches connecting these separate islands in such way as to close out the ocean and form an interior pond. Whether this theory be true or not, the present tendency of the ocean currents along the two beach sides of this pond, is, beyond question, to build up these beaches and stop off the outward flow of the water of the pond. This salt pond is of irregular shape, about 1¼ miles long and about two-thirds of a mile wide, its longest dimension running northwest and southeast. As measured from the latest survey maps, it now has about 700 acres of total area, of which about 500 acres is of 3 or more feet depth, about 300 acres is of 12 or more feet depth, about 150 acres is of 18 or more feet depth, and a few places are reported to be of as much as 60 feet depth (this latter being also that of the level of the ocean bottom at points 1,000 yards west or 2,000 yards east of the island). From one cause or another this pond is gradually filling up on its east and west sides, several high storm tides from the ocean having at times washed in large amounts of sand from the beaches, the high winds having at other times assisted in a similar way. On the south side, the middle of its west side, and the northeast side the banks are of rolling ground, occasionally rising into a small bluff of from 20 to 30 feet height, but on the rest of the north side the shore is low and marshy, and on the east and rest of the west side the shore is (as before stated) a low and sandy beach. The east beach is about 300 yards long and 200 yards wide, and the west beach is about 1,600 yards long and from 130 to 260 yards wide. The area of 18 feet depth lies nearest to the west beach. For many years past the outlet of this pond has been on its west side, but this outlet has been many times filled and closed up by washing or drifting sand, and during such closure the level of the pond has risen to from 3 to 5 feet above the ocean level. Such rising of the water, flooding the neighboring pastures and grounds, has caused so much trouble to the adjacent landowners

that the town has been obliged to reopen the outlet, often at considerable expense. The last outlet, made in 1887, at an expense of nearly $10,000, was cut to about 30 feet width and 4 feet depth, and has remained open until the present time, although it will probably close up eventually. The last surveys of this part of the pond show a recent filling of 5 feet depth (on an average) over 24 acres of this end of the pond, undoubtedly caused by sand washed into the pond through this cut during flood tides. The sand formations around the outer ocean end of the cut as well as elsewhere on this side of the island, indicate the existence of a littoral current northward along the west side of the island (probably due to the prevailing and strong southwest winds), which must carry large quantities of sand during rising tides.

It is this pond which the inhabitants of Block Island desire to be converted into a national harbor of refuge by means of a breachway through its western beach near its present outlet. This desire is of long standing. The arguments in favor of this work have been well and fully elaborated in a recent letter addressed to me by Mr. C. E. Champlin, State senator from that island district, and his letter is herewith appended. The advisability and practicability of such a work was carefully considered in 1868 by Col. Houston, Corps of Engineers, and his assistant engineer, Mr. Dresser, as well as by the board of engineers of that date. Their decision at that time was against the advisability of the project. Their full reports are to be found on pages 785 to 803, Annual Report of the Chief of Engineers, U. S. Army, for 1868. After a careful consideration of the arguments of State Senator Champlin and of the discussion of Col. Houston and Mr. Dresser, and after a personal visit to the locality and a study of the records of past surveys, all combined with a personal experience of over eight years in a fairly successful treatment of similar inlets on sandy coasts, I am of the opinion that a cut from this pond to the ocean (if made at all) should be made through the west beach at approximately the place selected by Mr. Dresser; should be fully 600 feet wide; should have a direction approximately northwest and southeast; should be dredged to from 20 to 25 feet depth; should be protected on both sides at its inner end by stone piers or jetties, at its center portion by stone revetments, and at its ocean ends by heavy sand-tight stone piers or jetties extending to 25 feet depth of water, all of which will be exceedingly expensive. Even if this be done in the above manner it is quite probable that the pond will continue to shoal, first to 25 feet depth throughout and afterward to a lesser depth, in which case large annual appropriations will be necessary for the maintenance of the improved harbor.

Considering the fairly good $300,000 breakwater and inner harbor already provided for medium-draft vessels on the east side of Block Island; and the $1,000,000 breakwater and harbor of refuge under construction at Point Judith, just opposite Block Island and more convenient and closer than it to the great highway of coastwise navigation from Long Island Sound past Block Island to Vineyard Sound; and the comparative ease with which large draft vessels can in northeast and southeast storms run quartering before the wind westward into Stonington Harbor, or in southwest and northwest storms into the Point Judith Harbor of Refuge or Narragansett or Buzzards Bay; and the comparatively small area of the Salt Pond available after all for 18-feet draft boats (only 1,200 yards long by 500 yards wide), much smaller and also much more difficult to enter than the Point Judith Harbor; and the possibility and probability of future shoaling; and the great

cost—considering all these, it appears to me that, as in 1868, it is still inadvisable to attempt to convert this Salt Pond into a national harbor of refuge.

I have, therefore, to state my opinion that, for the reasons above given, this breachway into Salt Pond, Block Island, is not, at present, worthy of improvement by the General Government.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 15, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local officer, confirmed by a personal inspection of the locality last September, I regard the breachway into Salt Pond, Block Island, Rhode Island, as wholly unworthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.

APPENDIX A.—STATEMENT OF HON. CHRISTOPHER E. CHAMPLIN, STATE SENATOR.

PROVIDENCE, R. I., *December 15, 1892.*

MY DEAR SIR: In connection with survey of Great Salt Pond, at Block Island, I would respectfully submit for your consideration the following facts, together with copy of petition (see Appendixes B and C) of the representative and prominent business men of the island requesting this movement. As to the importance of this project I desire to call your especial attention to the petition of the chamber of commerce of the State of New York to Congress, referred to by the Hon. E. M. Stanton March 16, 1868, then Secretary of War, in a communication to Hon. Z. Chandler, chairman of the Committee on Commerce of the United States Senate, praying for the construction of a harbor of refuge at Block Island of national importance; likewise to the recent action of the board of trade of Providence, R. I., December 13, 1892, a copy of which is hereto annexed (see Appendix D), requesting Congress, for similar reasons as those of the New York Chamber in 1867, that a harbor of refuge be constructed in the great Salt Pond at Block Island.

In 1867 it seems that two projects were considered for constructing a harbor at Block Island, one for local purposes, the other for general purposes. The former having then been decided upon, it is to revive the claims, then assigned, for harbor of refuge of national importance, together with the additional reasons for the protection of commercial interests commensurate with its growth for a quarter of a century, that the attention of Congress has been again called to this matter.

In a letter of D. C. Houston, Major of Engineers, under date of July 11, 1867, instructing Maj. G. M. Dresser to make survey at Block Island for harbor, the following language is found:

"There are two objects in view in making this survey: First, to secure a harbor which shall suffice for the needs of the inhabitants of the island, *i. e.*, a secure anchorage for the boats employed in fishing, and a place where steamboats and sailing vessels of light draft can land freight and passengers. Second, to make a harbor to be a harbor of refuge for vessels from all ports of the world which seek a harbor on those shores."

Later in a report from Maj. D. C. Houston to Gen. A. A. Humphreys, dated January 15, 1868, of the survey at Block Island, made by Maj. Dresser, after referring to the aforementioned instructions he uses the following language:

"The following are advanced as reasons why the Government should furnish a harbor for local purposes: First, it will foster the fishing interest in that locality, which is capable of being developed to a great extent, thus increasing the amount of cheap food which finds its principal market in Newport City and other points on the main land. Second, there being now one light-house on Block Island and another in contemplation, additional facilities are desirable for communication with and supplying them. Third, it will furnish a harbor of refuge for a large class of coasting vessels, and thus diminish the number of maritime disasters so numerous on this coast. A very large portion of the coasting vessels, including coal schooners, which pass to the south of Block Island and are not provided with charts or pilots, and are averse to seeking a harbor on the main coast, as at Narragansett Bay, desire a harbor close at hand and where the changes in the weather can be promptly observed and taken advantage of."

With the advantages as above outlined by Maj. Houston to be derived from a harbor for local purposes it is readily understood how the Board of Engineers, to whom this matter was referred, of which Board Maj. Houston was one, on the 6th day of March, 1868, when the smoke of the late war had barely cleared, with a sunken navy and a depleted National Treasury, should decide, to use their own language, that "there is no such necessity, *at least at the present time*," for the construction of a harbor for the protection of general commerce and navigation, as would justify the expenditure.

The protection anticipated by Maj. Houston in his third reason assigned for the construction of a harbor for local purposes, the protection to the coastwise trade, has never materialized, as is unquestionably established by the official report of the keeper of New Shoreham United States Life-Saving Station, herewith submitted (see Appendix E), which shows that in the last nine years, and when the present local harbor has been nearest completion, that there have been vessels wrecked in the local harbor and upon the breakwater to the amount of $77,450.

As a further evidence of the very slight protection that this present breakwater affords to commerce in general might be added the fact of the steamers *Block Island* and *Mount Hope* making their regular trips in summer to the island and not being able to land, which event occurs every year; and as recently as the early part of September of the present year the *Mount Hope* had to return after she had arrived at the island without landing her passengers, it being considered too rough to land.

In considering the advisability of location upon the Great Salt Pond as the point on Block Island to construct a harbor of refuge it is only necessary to consider separately some of the objections that have been made; the advantages of this point speak for themselves, and need no pen portrayal. The objections as mentioned are as follows, viz:

First. That the island of Block Island was originally two islands, separated by the Great Salt Pond, then the Atlantic Ocean, and since closed by sand thrown up from the bottom of the sea. Second. That the prevailing storms from which the most shelter is required are from the east, and that an entrance into this harbor would be in extreme cases impossible. Third. That it freezes in winter. Fourth. That a channel cut through the rim of sand on the westerly side of the pond 25 feet deep, at mean low-water mark 633 feet wide, with an average length at the bottom of the cut of 2,425 feet, would cost $1,000,000, and would probably fill up at the first heavy storm after it was completed.

I am not inclined to believe the theory that the island was originally two islands with the Great Salt Pond separating them, then the sea. There is no evidence to sustain this theory; on the contrary, there is evidence of a geological nature tending to dispute it, viz:

There are no rocks on the bottom of this pond, none around the shore such as are found on the shores of the ocean around Block Island. There are no bowlders and beach stones such as line the ocean shore. At Commorant Point, as it is commonly called, a point on the westerly part of the pond, projecting northerly into the pond, the water is very bold. At this point one can stand on the shore and jump into 10 feet of water, the shore runs off so abruptly. If the theory that this pond was once a part of the sea is correct this point would have been the most exposed portion of the shore, and the sea must have dashed against it first. Would not the action of the waves, the tide rising and falling, have worn the sandy soil at this point and shoaled the water there, as it has on the shore of the ocean all around the island? And if it had been once shoaled, what could have deepened it again to within a very few feet of the rim of sand which separates the pond from the ocean to a depth which is not found hardly in the sound which separates the island from the mainland?

Compare the depth of water and its proximity with the shore at this point with that depth found where the seas have rolled, as shown on the coast survey, anywhere around the island, and they bear no evidence of similarity. The shore of the pond bears no evidence of ever having been gnawed into by the sea, as is the case on the

ocean shores of the island, and especially on the southern and eastern sides, where the high banks stand out boldly and overhanging, nearly as high as the Palisades of the Hudson; yet the shores deepen gradually and not abruptly. The shores of this pond are exactly similar to the shores of the other ponds on the island, of which there are many, some 300 in all, it having been estimated that about one-seventh of the area of the island consists of ponds. (Rhode Island State Census, 1885, p. 27.)

Some of these ponds are quite large, notably Sands Pond and the Fresh Pond, both of which are located on very high land, much higher than the level of the sea, thus negativing the theory that the ocean feeds them, while others, such as Chagum Pond and Middle Pond, are separated only by a narrow rim of sand from the sea, as is also the Harbor Pond, each on different parts of the island and distant from 4 to 6 miles.

The more natural and rational theory of their formation is, in my opinion, that they are simply the collected surface water of the island, which, owing to the unevenness of the surface, is not so readily soaked into the ground and collects where the hollows or depressions of the surface are of such material as is best adapted for standing water.

These ponds are nearly all connected. The Great Salt Pond being the lowest portion of the island, the other ponds empty their overflow into it. Thus the Great Salt Pond, which drains the island, was, before a sufficient outlet was opened into the sea raised higher than the sea level and caused the lower portions of the pond shore to be submerged until it overflowed the rim of sand which separates the pond from the sea. The annual depth of rainfall at Block Island for the three years of 1888, 1889, and 1890 was 27.18 inches, 32.80 inches, and 31.51 inches, respectively, as shown by the annual reports of the Chief Signal Officer of the United States, based upon the observations of the meteorological observer, Block Island Signal Station. The originals for the years mentioned are herewith submitted. (See Appendix L.*)

The low portions of the adjoining lands, prior to the year 1887, were constantly being overflowed, as appears by the records of the town clerk of the town meetings providing for keeping the water off of the highways which run along the south and easterly side of the pond and over the low beach land on the east, copies of which records from the year 1867, when the survey of this pond was made by Maj. Dresser, to the opening of the inlet in 1887, are herewith submitted.*

This collection of surface water, formerly having no outlet, narrowed the rim of sand separating the pond from the ocean (these portions being the lowest), and this explains the difference in the width now, when the pond is not full, than formerly. That the strips of land separating the pond from the sea are lower than other portions would naturally result from the surface water overflowing and thus moving the sandy soil, leaving the harder soils in their natural and original positions, and this would seem to have been the case on the westerly rim of the pond, where we find two separate portions of upland, surrounded by sandy stretches of beach land, which separate portions of upland are, in area, from 15 to 20 acres, and extend from the pond to the sea, the soil of each consisting of hard loam. Strange as it may seem to the theorist of two islands, this hard soil separates the deepest water in the pond from the sea, and if the theory of two islands is correct it must have been thrown up by some volcanic eruption, not being similar to the formation of the bottom of the sound, which, we are informed, is sand.

Whatever may have been the origin of the Great Salt Pond in Block Island, whether fed by springs, collected surface water, or formerly an arm of the sea and having subsequently choked at both ends simultaneously, so as to maintain a sort of picturesque coast line merely, there is no evidence of the latter theory outside the field of conjecture.

The earliest history and known record of the island's discovery by the civilized world was made in 1524 by Verrazzano, a French navigator, who, in his report to his sovereign, Francis I, of France, records it as being about 50 leagues east of New York and 3 leagues from the mainland, and described its shape as triangular, full of hills covered with trees.

In 1680, eight years after the town was incorporated, a harbor company was formed to make a harbor in the big pond, and in their petition to the Rhode Island Assembly described the rim of sand on the westerly shore of the pond as being about the same width as at present, the size and depth being described as "big enough and deep enough to hold the whole English navy."

Second. In reply to what has been said about the prevailing winds of the island being from the east, in which shelter is most needed, I would respectfully call your attention to the reports of the Chief Signal Officer of the United States, based upon the observations taken by the meteorological observer at the signal station at Block Island for the last ten years, the originals for 1881, 1882, 1883, 1884, 1886, 1887, and 1890, are herewith submitted. (See M, etc.,* herewith.)

These official reports unquestionably establish the facts that neither are the pre-

* Omitted.

vailing winds from the east, nor the times when shelter is most needed, as is indicated by the velocity of the winds, at times when the wind is from the east.

The prevailing winds are from the southwest and northeast, and if the channel was cut through the rim of sand on the westerly side of the pond running east and west, there would be no occasion to beat into the pond through the channel in either a southeast storm or a northeast storm. These winds through a channel running east and west, for so short a distance, would be fair winds, and the same would be equally true in getting out of the harbor in a northwest or southwest wind. These facts are too well established to need further proof. Nature seems to have intended this point of the pond to be opened to the sea. It would open into a sound about 10 or 12 miles wide, protected on the westerly and northerly sides by the Rhode Island shore, the seas on which sound must in the nature of things be short, and what is known as a "chop-sea," when the winds are from the west or north. When the winds are from any other point than west or north, this opening on the westerly side of the pond is facing and emptying into the lee shore or side of the sound, any part of which for 4 miles along the westerly side of the island is good and safe anchorage, with the wind from the east, thus disposing of the necessity of, and the objection to, beating through the narrow channel with the wind from the east. When the wind is from the west, the current through the narrow channel would take vessels out. There is no harbor that has no head winds to get in or out of.

Third. Would this pond, with a ship channel connecting it with the ocean, completely freeze in winter?

In answering this question I shall again ask you to refer to the meteorological records of the Signal Office at Block Island for the last four years, or since 1887. The originals for 1888 and 1890 are herewith inclosed. (See N.* herewith.)

These reports show that during the winter months the minimum temperature is at zero, and below in several instances; yet the fact remains that the Great Salt Pond has never been frozen over since the year 1887, when the water became salt, and the tide began to ebb and flow in it, by the opening of the present breachway. Why should this pond freeze when connected with the ocean, with a depth of 60 feet of water and an area of 800 acres in a body, with the mean annual temperature of Block Island higher than any other place of the same latitude in the United States, as shown by Chief Signal Officer's reports before referred to?

Fourth. Would the channel fill with sand if properly constructed and protected, and would it cost, as previously mentioned and described, $1,000,000?

To the first portion of this question, is it not an admitted fact that sand shifts differently at different points along the coast, and does it not depend upon the peculiar circumstances surrounding each particular case? Is it reasonable to presume that the same causes which filled up the breechways at Charlestown Pond or along the southern shore of Rhode Island, which open into the teeth of of a southeast gale, washed and beaten by seas that have an expanse of thousands of miles of ocean to deepen upon, Block Island breaking the force of the same about as much as a pole put down in a mill tail would operate to fill up a channel facing a fair-weather wind and a short-chop sea? Is it not rather a violent presumption that because a rude, unprotected ditch dug in the sand for the purposes of draining water from this pond, filled up in the year 1867, that a ship channel properly constructed would choke up from the same causes, and a constant expenditure would be necessary to dredge it out? Would not the strong current either to or from the pond, which the narrow channel would necessarily cause, rather tend to keep the channel clear of sediment and sand rather than occasion deposits therein? Besides, is it not an admitted fact that, with the conditions as previously mentioned, with an opening at this point, sand would not move in water 25 feet deep?

Therefore, with the entrance properly protected by sand-tight breakwaters to a sufficient depth into the ocean, would it not render it practicably safe to keep open and dispel any occasion for alarm from sand?

The last part of the fourth question, would such a project as mentioned cost $1,000,000?

In answer to that I do not believe that it would. In reference to the estimate placed upon this project by Maj. Dresser in 1867, it is only necessary to say that an estimate of from $300,000 to $500,000 as the cost of putting into a breakwater 24,000 cubic yards of stone, conveys a very indefinite idea of the cost of such a project, and sounds more like a glittering generality than an actual fact.

As to the importance of such a harbor at this point, and as tending to show the extent of the commercial interest and the protection which this harbor would afford, the official reports of the keepers of the life-saving stations at Block Island during the years of 1890 and 1891, and in the aggregate for twelve years at the New Shoreham Station, of the number of crafts passing Block Island in the daytime and sighted by the keeper of these stations, is herewith submitted. (See appendixes F, G, H.)

* Omitted.

Some idea of the value of the foreign trade and the property invested and hazarded on a foreign coast, and for the protection and safe guidance into port our pilots are relied upon wholly, may be obtained from a copy of the report of the board of pilot commissioners of Rhode Island, showing the number of foreign vessels, for the last five years, that have passed Block Island and entered at the pilot commissioners' office in Providence, which is herewith submitted. (See Appendix K.)

The amount of the actual receipts to the Government for the entry of the foreign trade at the port of Providence for the years 1871 to 1885, inclusive, is $3,422,464.24, or an average annual receipt of $244,461.73, as appears by the Rhode Island State census of 1885, page 80.

The location of a harbor of refuge at this point, being at the extreme eastern end of the greatest marine highway in the United States, 12 miles at sea in mid-ocean, a point exposed and dangerous to the foreign trade, and the first land made by the foreign Providence-bound merchantmen, affording the coast protection by revenue cutters, a commanding position (in the fiercest easterly gale) of the entire coast of southern Massachusetts, Rhode Island, and Connecticut, and a key to Long Island Sound, the great marine highway to the metropolis, together with the great advantages to the new cruisers and navy in case of foreign war in our coast defense, will, I trust, after the lapse of a quarter of a century of national prosperity since this movement was first before Congress, commend itself to you as a project worthy of improvement, practicable, and one that will warrant and justify the expenditure necessary for its construction.

I respectfully remain, your most obedient servant,

CHRISTOPHER E. CHAMPLIN,
State Senator, New Shoreham.

Hon. W. H. BIXBY,
Captain of Engineers.

APPENDIX B.—PETITION OF CITIZENS OF NEW SHOREHAM, BLOCK ISLAND.

To Christopher E. Champlin, senator, and George W. Conley, representative, of the town of New Shoreham, in the general assembly of the State of Rhode Island.

We, the subscribers, citizens of the town of New Shoreham, do most respectfully represent that the Great Salt Pond in New Shoreham contains about 800 acres of tide water available and suitable for the anchorage of ships and vessels; that the commercial interests of the town, the State, the United States would be greatly improved and benefited by causing the channel connecting this natural harbor with the ocean to be widened and deepened with a view of making a permanent harbor of refuge therein.

That we firmly believe that such a project is practicable and that an appropriation from the General Government for such purpose is necessary for the development and proper protection of the commercial interests of the United States.

We would, therefore, most urgently request you, as the representatives of the people of New Shoreham, to use your influence with the Senators and Representatives of the State and Congress to procure an appropriation for such purpose.

LORENZO LITTLEFIELD,
Ex-Senator.
And 149 others.

APPENDIX C.—PETITION OF CITIZENS OF NEW SHOREHAM, BLOCK ISLAND.

To the honorable general assembly of the State of Rhode Island at its January session, 1893:

We, the undersigned citizens of the town of New Shoreham, island of Block Island, would respectfully represent that by an act of Congress passed in July, 1867, a survey was ordered to be made here in reference to the building of the harbor of refuge at this island.

A thorough and favorable survey having been made in the Salt Pond under that act, we believe that the interest of the large coasting trade between Boston and New York and the general marine interest of the United States demand such, and would be vastly benefited if a harbor of refuge could be made in the said Salt Pond, as also great advantages would result to our Navy by giving our vessels a harbor for refuge and supplies, especially in time of a foreign war.

We would, therefore, respectfully ask your honorable body to take such action upon the subject as will call the attention of Congress to this matter of national importance, and, as in duty bound, will ever pray.

NICHOLAS BALL.
And 4 Others.

APPENDIX D.—RESOLUTION OF BOARD OF TRADE, PROVIDENCE, R. I.

To the honorable Senate and House of Representatives of the United States in Congress assembled:

Whereas the Great Salt Pond in New Shoreham on Block Island, in the State of Rhode Island, contains about 800 acres of tide water available and suitable for the safe anchorage of ships and vessels during storms; and

Whereas, believing that the commercial interests of this State and the United States demand the protection of its shipping by making an harbor of refuge at Block Island: It is therefore

Resolved, That the board of trade urgently requests the United States Government to take such action as is necessary to make this pond an arm of the sea and to appropriate a sufficient amount to make a permanent harbor of refuge therein.

Resolved, That the Representatives in Congress from this State be requested to use their efforts to aid in forwarding this matter.

Resolved, That a copy of these resolutions be forwarded to the Senators and Representatives in Congress from Rhode Island.

Passed by the board of trade of Providence, December 13, 1892.

APPENDIX E.—STATEMENT OF KEEPER OF NEW SHOREHAM LIFE-SAVING STATION.

THIRD U. S. LIFE-SAVING DISTRICT,
New Shoreham Station, Block Island, R. I., December 12, 1892.

I would respectfully say that the number of vessels wrecked within the patrol limits of New Shoreham Life-Saving Station from January 10, 1883, to November 29, 1892, and valuation of same will be as follows:

SAVED.

Date.	Where wrecked.	Valuation.
Jan. 10, 1883	In inner harbor	$18,000
Do	do	300
Do	do	300
Do	do	50
Apr. 14, 1883	In outer harbor	700
Jan. 6, 1883	On east side of island	2,100
June 5, 1883	On north end of island	1,800
Sept. 25, 1883	do	300
Dec. 1, 1883	do	18,000
Jan. 7, 1884	do	300
Jan. 9, 1884	In inner harbor	1,800
Do	do	350
Feb. 20, 1884	do	1,800
Do	do	1,000
Apr. 22, 1884	On east side of island	4,000
Oct. 16, 1884	On breakwater	500
June 26, 1884	On north end of island	500
Mar. 20, 1885	On breakwater	3,000
June 5, 1885	do	5,100
Do	do	8,150
Do	do	4,100
July 20, 1885	On north end of island	1,400
Feb. 6, 1886	On breakwater	2,500
July 6, 1886	On west part of island	7,000
Oct. 10, 1886	In outer harbor	1,000
Feb. 5, 1887	In inner harbor	500
Feb. 20, 1887	On east side of island	2,000
May 22, 1887	do	1,766
Aug. 26, 1887	On north end of island	1,100
Oct. 2, 1887	On breakwater	500
Oct. 21, 1887	In outer harbor	1,000
Do	On east side of island	400
Nov. 4, 1887	do	500
Do	do	500

SAVED—Continued.

Date.	Where wrecked.	Valuation.
Feb. 9, 1888	On east side of island	$7,000
Feb. 25, 1888	do	5,200
Apr. 14, 1888	do	1,000
May 19, 1888	do	5,700
Mar. 12, 1888	In inner harbor	2,000
Do	In outer harbor	1,000
Do	do	2,500
Do	do	700
May 19, 1888	On east side of island	600
July 8, 1888	On breakwater	1,300
Oct. 24, 1888	do	800
Aug. 19, 1889	On north end of island	500
Sept. 10, 1889	On breakwater	300
Oct. 10, 1889	do	2,000
Jan. 6, 1890	do	5,000
Apr. 18, 1890	do	1,600
Aug. 27, 1890	do	5,000
July 13, 1891	On north end of island	2,000
Oct. 21, 1891	On east side of island	2,000
Dec. 4, 1891	On outer harbor	1,500
Oct. 23, 1891	On inner harbor	1,000
Do	do	800
Nov. 29, 1892	On outer harbor	1,300
	Total saved	143,216

LOST.

Jan. 3, 1884	On north end of island	5,800
Feb. 2, 1884	On east side of island	7,300
Dec. 25, 1885	On north end of island	3,000
Apr. 1, 1887	On breakwater	500
Oct. 21, 1887	On east side of island	9,000
	Total lost	25,600

A. N. LITTLEFIELD,
Keeper.

APPENDIX F.—STATEMENT OF KEEPER OF BLOCK ISLAND LIFE-SAVING STATION.

THIRD U. S. LIFE-SAVING DISTRICT,
Block Island Station, November 15, 1892.

DEAR SIR: By your request I have made a note from my journal of all the vessels that have passed in sight of this station in the two years of 1890 and 1891.

Ships	46	Schooners	14,282
Barks	122	Steamers	2,269
Brigs	82	Sloops	962

Respectfully,

N. D. BALL,
Keeper of Block Island Station.

Mr. R. S. LITTLEFIELD,
Block Island, R. I.

APPENDIX G.—STATEMENT OF KEEPER OF NEW SHOREHAM LIFE-SAVING STATION.

THIRD U. S. LIFE-SAVING DISTRICT,
New Shoreham Station, Block Island, R. I., November 22, 1892.

During the years of 1890 and 1891 I would respectfully say the number of vessels passed in sight of this station as follows:

Schooners	18,189	Sloops	3,003
Steamers	2,866	Barks	54
Ships	12	Brigs	54

A. N. LITTLEFIELD,
Keeper of New Shoreham Life-Saving Station.

APPENDIX H.—STATEMENT OF KEEPER OF NEW SHOREHAM LIFE-SAVING STATION.

THIRD U. S. LIFE-SAVING DISTRICT,
New Shoreham Station, Block Island, R. I., December 12, 1892.

I would respectfully say the number of vessels passed this station during the last twelve years are as follows: 709,116.

A. N. LITTLEFIELD,
Keeper.

APPENDIX K.—NUMBER OF VESSELS ENTERED PORT OF PROVIDENCE, PASSING BLOCK ISLAND, FROM FOREIGN PORTS.

Quarter ending—		Quarter ending—	
May 31, 1887	22	Aug. 31, 1890	51
Aug. 31, 1887	42	Nov. 30, 1890	56
Nov. 30, 1887	62	Feb. 28, 1891	23
Feb. 29, 1888	34	May 31, 1891	22
May 31, 1888	32	Aug. 31, 1891	37
Aug. 31, 1888	37	Nov. 30, 1891	34
Nov. 1, 1888	24	Feb. 29, 1892	12
Feb. 28, 1889	16	May 31, 1892	15
May 31, 1889	29	Aug. 31, 1892	41
Aug. 31, 1889	32	Nov. 30, 1892	44
Nov. 30, 1889	29		
Feb. 28, 1890	17	Total	745
May 31, 1890	34		

As reported.

F. M. BURROUGH,
Chairman of Board.

C 31.

PRELIMINARY EXAMINATION OF STONINGTON HARBOR AND ITS ENTRANCE, CONNECTICUT.

UNITED STATES ENGINEER'S OFFICE.
Newport, R. I., June 12, 1893.

GENERAL: In accordance with the river and harbor act of July 13, 1892, and orders from your office dated July 14, 1892, I have the honor to submit the following report upon a preliminary examination of Stonington Harbor, Connecticut, and the entrance thereto:

This examination was made by Lieut. W. W. Harts, Corps of Engineers, under my orders. His full report is appended. My opinions, as below stated, are based partly on his report and partly upon my own personal knowledge, inspection, and careful study of this special locality. The statements as to the present and prospective demands of commerce are compiled mainly from replies to numerous letters addressed by me to the chairman of the United States Senate Committee of Commerce and of the United States House Committee of Rivers and Harbors, to the United States Senators and Representatives, in whose State and district the improvement lies, and to postmasters, collectors of customs, and to such other prominent persons of the neighborhood as were supposed to be interested therein, all of whom were requested to give addresses of other interested parties and to contribute such information and assistance as was at their disposal.

Stonington Harbor (see Coast Survey Chart No. 358) is one of the important harbors of eastern Connecticut. It derives its importance

to-day, first, as a harbor of refuge (being the harbor nearest to the ocean end of Long Island Sound), and next as a place of trans-shipment of passengers and freight from boat to rail on a through route (the Stonington Line) from New York and the west to Boston and the east. As a harbor it has a good protection on three sides by the mainland and on the fourth side by a couple of breakwaters built by the General Government between 1872 and the present date; but its wharfage depth is limited to only about 12 feet at mean low water, although vessels of 18 feet draft can find shelter behind its breakwaters.

The present water commerce of the harbor is reported as about 70,000 passengers and 200,000 tons freight ($83,000,000) per year; almost all of this being a through travel over the combined steamboat and railroad line. This commerce is estimated at having developed nearly 80 per cent in the last thirteen years, or about 6 per cent per year.

This harbor has been since 1828, and is now, under improvement by the General Government; during which time $338,000 have been spent in obtaining its present good harbor protection and its present 12 to 18 feet depth of harbor and anchorage. (Some work still remains to be done upon its breakwaters to complete the already approved projects for the improvement of this harbor; but such work is already provided for by such past projects.) During the interval from 1828 up to the present time the size of vessels and steamboats has steadily increased and the needs of increased facilities of navigation have increased in equal ratio. To-day it appears desirable to straighten the entrance to the harbor by a cutting across Noyes Shoal, and to dredge a channel of at least 200 feet width and 17 feet depth up to opposite the city docks.

The practicability of the cut across Noyes Shoal will depend upon the nature of the bottom (easy dredging on its surface, but untested below), only to be determined by a special survey. This cut, if made deep enough to allow of use during heavy swells and rough weather will probably require the excavation of from 200,000 up to 800,000 yards of material.

The steady increase in the use of this harbor during past years, combined with the present large amount of commerce, and the fact that this commerce is mainly a through traffic between different States, all these are regarded by me as excellent and strong reasons for additional improvement by the General Government.

I have therefore to state my opinion that for the reasons above given, this harbor is worthy of further improvement by the General Government and to submit my estimate of $1,200 as an amount that will enable me to make a survey and report, including a project, with estimate of the cost of the improvement proposed.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. THOS. L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 15, 1893.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

For the reasons stated by the local officers I regard Stonington Har-

bor worthy of improvement by the General Government; also that the cost of the needful survey and detailed project may properly be estimated at $1,200.

HENRY L. ABBOT,
Colonel of Engineers,
Bvt. Brig. Gen., U. S. A., Division Engineer.

REPORT OF LIEUT. WM. W. HARTS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 12, 1893.

CAPTAIN: In compliance with your instructions of December, 1892, I have the honor to submit a report upon the examination of Stonington Harbor, Connecticut, with a view to its further improvement by the General Government.

Information as to this harbor was asked by circular letters sent to persons supposed to be interested in its improvement. To these letters but a few replies have been received. The information embodied in the following report was principally obtained from a visit to the locality, from inquiries of steamboat captains and from maps and previous reports. (For maps of this harbor, see Coast Survey Chart No. 358, and Report of Chief of Engineers for 1882, p. 593; for 1884, p. 632, and for previous reports, see Annual Report of Chief of Engineers for 1872, p. 917; for 1881, p. 585.)

Description.—Stonington Harbor lies on the northern shore of Fishers Island Sound, Connecticut, and toward its eastern end, and is an indentation in the mainland of Connecticut about 10 miles east of New London, Conn., and about 40 miles west of Newport, R. I. This harbor is naturally protected on the north, east, and west by the mainland and only partially on the south by Fishers Island and the other islands lying in this sound. The Atlantic Ocean is but a very short sail from this harbor, and because of this and the protection afforded in easterly and northerly storms, this harbor was used in very early times as a refuge for coasting vessels. The harbor later was artificially protected by stone breakwaters, one small one extending west from the town, one extending south and east from Wamphassuck Point, and another lying farther to the south and east, extending from Bartlett's Reef to Middle Ground. These breakwaters, with the natural protection, have formed a safe harbor for all storms, which harbor is now extensively used by coastwise sailing vessels. As a place of refuge it is easily accessible and well located with regard to the ocean and Long Island Sound.

There is a depth of about 12 feet over a large area of the inner harbor near the docks, increasing to about 20 feet near the eastern breakwater. The mean rise and fall of the tides is 2.7 feet. On a peninsula forming the east side of this harbor is located the town of Stonington, a village at present of about 8,000 population. The town was formerly the headquarters of very important whaling industries and is now the terminus of the Stonington steamboat line, a point of transshipment of freight and passengers from New York to Boston and other eastern towns. There are valuable quarries of granite and brownstone near the town. There are no manufactories of any note, and except the before-mentioned industries there are no local enterprises of special importance.

Navigation.—The lights and buoys make the navigation of this part of Fishers Island Sound a comparatively easy task to a fairly experienced pilot. Vessels drawing 11 feet can easily reach the city docks and vessels drawing up to 18 feet can take shelter behind the breakwaters. There are, however, several shoals that are troublesome to deeper vessels entering by the west passage and some further shoals within the harbor proper, all of which, more or less obstruct its easy navigation. Since the construction of the breakwaters there has been some shoaling in this harbor, due possibly to their checking the outward flow of the sediment-bearing currents. This shoaling with the steady increase of draft of the vessels that navigate this harbor have of late years made it impossible for many of these vessels to carry their maximum load of freight, compelling them at certain stages of the tide to leave the harbor only partially laden.

Commerce.—The commerce of this port is of considerable value and has always been large for the size of the town. The fisheries are an important industry and much brownstone and granite is shipped for building and paving. The Providence and Stonington Steamship Company use this harbor as a freight and passenger terminus. They own and use eight vessels, valued from $600,000 to $1,000,000 and carrying about 70,000 passengers annually and about 200,000 tons of freight. About 25,000 vessels

annually pass the lightship at the entrance to the harbor. From statistics furnished by the collector of the port, Mr. C. T. Stanton, and estimates from previous years where better information could not be had, it is thought that the following estimate of the port for 1892 is a fair one:

Exports:		
3,000 barrels fish, at $8	$24,000	
30,000 tons stone (paving), at $1.50	45,000	
		$69,000
Imports:		
1,500 tons sand (molding), at $5	7,500	
62,000 bushels grain, at 50 cents	31,000	
200 tons hay, at $10	2,000	
1,124,000 brick, at $6 per 1,000	6,744	
56,617 tons coal, at $5	283,085	
3,225 tons iron, at $9	29,025	
100 tons fertilizer, at $20	2,000	
1,500 barrels oil, at $10	15,000	
1,000 tons merchandise, at $400	400,000	
5,000 M feet lumber, at $30	150,000	
Total		926,354
Passing through harbor (from water to rail, or *vice versa*):		
68,442 passengers, at $2.17 per fare	147,846	
206,000 tons merchandise, at $400	82,400,000	
		82,547,846
Total exports and imports		83,543,200

In the above table the quantities have been received from reliable sources, but the prices have been estimated as near as possible from the information at hand.

The increase in business may be shown from a comparison of the business of 1877 and 1890, as furnished by the collectors of customs in those years:

	1877.	1890.
Cargoes received	$22,378,440	$38,000,000
Cargoes shipped	21,940,000	37,000,000
Entering harbor of refuge	2,250	3,600

Former improvements.—This harbor having been in use by the merchant marine of the United States since very early times, it was likewise at a very early date that improvements here were first made by the General Government.

Formerly an open harbor, some protection against southerly storms for the vessels frequenting it, was so much needed that in 1827 Congress ordered its examination and survey. This was made in 1827 by Lieut. J. Prescott, First Artillery, who recommended an improvement and furnished a project providing for the construction of a stone pier on the east side of the harbor, extending in a westerly direction, to act as a breakwater, at a cost of $44,000. Congress, acting on this report, appropriated, in 1828, $20,000 "towards erecting piers or other works at or near Stonington Harbor, in the State of Connecticut, for the purpose of making same a good and safe harbor." In 1830, $16,491.67 was further appropriated for this purpose. From these appropriations the pier was built substantially as recommended by Lieut. Prescott, being 740 feet long and about 12 feet wide on top. Nothing further was then done for many years.

In 1871, to meet a demand for better harbor protection and anchorage area, Congress ordered another survey, which was made in the same year under direction of Gen. Warren, of the Corps of Engineers. In his report upon this survey (see Annual Report of Chief of Engineers for 1872, p. 917) Gen. Warren recommended the construction of a breakwater extending out from Stonington Point to the south and westward, a sea wall or second breakwater on Wamphassuck Point extending to the south and eastward, and a certain amount of dredging to increase the depth of channels and anchorages.

Congress appropriated, in 1873, $25,000 for deepening and dredging the approaches to this harbor; and in 1874, $20,000 more to continue this improvement.

In 1875 $25,000 was appropriated; in 1878, $40,000; and in 1879, $37,500; all of which money was expended in constructing the breakwater from Wamphassuck Point. This breakwater was completed in 1881 at a total cost of $103,190. It is 2,025 feet long and contains 94,158 gross tons of granite.

In 1880, $25,000 to continue improvements at Stonington was appropriated by Congress, and as only a small amount of this was required in the completion of the Wamphassuck Point breakwater, a project for the expenditure of the remaining amount in the construction of an eastern breakwater, to further screen this harbor from southerly and southeasterly storms, was approved. This breakwater was to extend from the south end of Bartletts Reef to the north end of the middle ground. In 1881, $30,000 was appropriated to continue this construction; in 1882, $25,000 further was appropriated for the same purpose; in 1884, $10,000; in 1886, $20,000; in 1888, $8,000; in 1890, $12,500; in 1892, $12,500, making a total of $143,000 appropriated for the eastern breakwater.

These improvements (costing in all $338,619.83), have had the effect of providing a very safe and sheltered harbor of from 12 to 18 feet depth. Formerly in southern gales much damage was done to the shipping; but there seems to be at present thorough protection. Steamboat captains who have known this harbor for many years speak in high praise of the efficiency of the breakwaters.

Present needs.—Extending southeast from near Noyes Rock there is a long narrow shoal almost directly across the entrance and between the ends of the breakwaters. The minimum depth on the shoal is about 11 feet. There are deep channels around the ends of this shoal, but of difficult navigation. It appears desirable now that part of this shoal should be removed to allow the easy navigation of this harbor of vessels drawing up to 15 or 16 feet.

The inner harbor should also have a channel in the upper part of at least 200 feet width and 17 feet depth, to allow all vessels to reach the city docks. Dredging from private docks to this channel could then be done by the owners of the docks.

These improvements, if made, would doubtless be of much value to all deep-draft vessels.

There still remains to be built about 200 feet on the west end of the eastern breakwater; but this work is provided for under the present project. The extremity of this uncompleted western end has not, however, been as yet fixed definitely in position, and there seems at present to be a question as to the exact length necessary. The breakwater at present seems to fulfill the demands upon it, but its extension would materially increase the deeper anchorage area, and give increased protection to the whole harbor against southerly winds, and for this reason would be of much value not only at the present time but for some years to come.

Recommendations.—In my opinion this harbor is "worthy of improvement by the General Government." I have therefore to recommend that a detailed survey be made to determine the extent and location of the areas to be dredged and the character and amount of material to be excavated. It is estimated that such a survey may cost from $800 to $1,200.

Respectfully submitted.

WM. W. HARTS,
Second Lieut., Corps of Engineers, U. S. A.

Capt. W. H. BIXBY,
Corps of Engineers, U. S. A.

APPENDIX D.

IMPROVEMENT OF CONNECTICUT RIVER AND OF RIVERS AND HARBORS IN CONNECTICUT AND NEW YORK TRIBUTARY TO LONG ISLAND SOUND, AND ON SOUTHERN SHORE OF LONG ISLAND.

REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mystic River, Connecticut.
2. Thames River, Connecticut.
3. Connecticut River, Massachusetts and Connecticut.
4. Harbor of refuge at Duck Island Harbor, Connecticut.
5. Clinton Harbor, Connecticut.
6. New Haven Harbor, Connecticut.
7. Breakwaters at New Haven, Conn.
8. Milford Harbor, Connecticut.
9. Housatonic River, Connecticut.
10. Bridgeport Harbor, Connecticut.
11. Black Rock Harbor, Connecticut.
12. Saugatuck River, Connecticut.
13. Norwalk Harbor, Connecticut.
14. Wilsons Point Harbor, Connecticut.
15. Five Mile River Harbor, Connecticut.
16. Stamford Harbor, Connecticut.
17. Harbor at Cos Cob and Miamus River, Connecticut.
18. Port Chester Harbor, New York.
19. Larchmont Harbor, New York.
20. East Chester Creek, New York.
21. Greenport Harbor, New York.
22. Port Jefferson Harbor, New York.
23. Huntington Harbor, New York.
24. Glen Cove Harbor, New York.
25. Flushing Bay, New York.
26. Patchogue River, New York.
27. Browns Creek, Sayville, New York.

EXAMINATIONS.

28. Westport Harbor, Connecticut.
29. Norwalk Harbor, Connecticut.
30. Berrians Creek, Long Island, New York.
31. Southold Harbor, Long Island, New York.

HARBOR LINES.

32. Shaws Cove, New London Harbor, Connecticut.
33. Bridgeport Harbor, Connecticut.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., July 10, 1893.

GENERAL: I have the honor to transmit herewith the annual reports upon the works of river and harbor improvement under my charge for the fiscal year ending June 30, 1893.

Col. D. C. Houston, Corps of Engineers, was in charge of these works up to May 18, 1893; he was succeeded by First Lieut. Thos. H. Rees, Corps of Engineers, who remained in temporary charge till June 12, 1893.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

D 1.

IMPROVEMENT OF MYSTIC RIVER, CONNECTICUT.

Mystic River is a narrow tidal stream in the eastern part of the State of Connecticut, about 7 miles west from the boundary of the State of Rhode Island. The navigable part of the river extends in a general north-northeasterly direction for nearly 4 miles from Fishers Island Sound past the villages of Noank, Mystic River, and Mystic Bridge, above which places it receives the discharge of several small fresh-water streams. The villages of Mystic River and Mystic Bridge lie respectively on the west and east banks of the river, opposite each other, about 3 miles above Fishers Island Sound; at this point the river is crossed by a highway bridge with a draw. Nearly a half mile further down is the drawbridge of the New York, Providence and Boston Railroad, and about 1½ miles still further the village of Noank lies upon the west bank. The population of Mystic River and Mystic Bridge together is about 4,000; that of Noank about 2,000.

Directly opposite the mouth of the river lie Mystic or Ram Island and Ram Island Shoal, which cause the channel to divide and branch off sharply to the northeast and southwest. The northeast channel is 18 feet or more in depth and of sufficient width, but crooked; it is the one used by large vessels. The southwest channel opens out into a broad flat, with about 12 feet available depth.

The river channel up to within about a half mile below the highway bridge had a natural low-water depth of 15 feet or more; its width, from 80 to 300 feet, was sufficient, but there were several bends in its course which made it somewhat difficult of navigation. The mean rise of tide in Mystic River is about 2½ feet.

PROJECT FOR IMPROVEMENT.

Under act of Congress of August 11, 1888, a preliminary examination of Mystic River was made. In the report on this examination, dated October 26, 1888, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, p. 746, a project for improvement was submitted, which consisted in dredging to make the channel 15 feet deep at mean low water and 100 feet wide, and to reduce five bends in the channel. The estimate of cost, based upon the U. S. Coast Survey chart of 1882, was as follows:

160,000 cubic yards, at 16 cents	$25,600
Supervision and contingencies, say	4,400
Total	30,000

The beginning of work under this project was approved by the Secretary of War November 1, 1890, after the first appropriation for improving the river had been made, and up to July 1, 1892, the channel between the bridges was made from 75 to 200 feet wide and 15 feet deep; for 650 feet below the railroad bridge it was made 75 feet wide and 15 feet deep, with a depth of 12 feet for an additional width of 23 feet; at the lower bend, opposite the beacon, the 15-foot channel was widened 75 feet for a length of 750 feet at the sharpest part of the bend, and for a distance of about 1,000 feet above it was widened 25 feet, making its present width 175 feet.



OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

By act of Congress approved July 13, 1892, $10,000 was appropriated for continuing this improvement, and after duly advertising for proposals for dredging, a contract was entered into with the Hartford Dredging Company to remove about 25,000 cubic yards of sand and mud at the rate of 14.3 cents per yard. Work under this contract was begun October 12 and the contract was completed December 3, 1892, 25,975 cubic yards being removed; under open-market transaction with the same contractors, and at the rate specified in the contract, under authority of the Chief of Engineers, dated December 2, 1892, dredging was continued until December 23, when it was suspended on account of ice, 12,059 cubic yards having been dredged. Work under the open-market transaction will be resumed about August 1, 1893.

The total amount dredged from this river during the past fiscal year was 38,034 cubic yards. From the railroad bridge down stream to the first bend the channel was widened by 25 feet, making it 100 feet wide, and removing shoal spots in the old channel; at the first bend it was widened 100 feet, rounding off the bend and making the channel from 100 to 160 feet wide; at the second bend, near the Quarry Wharf, it was widened by 50 feet; depth made, 15 feet at mean low water.

PRESENT CONDITION OF IMPROVEMENT.

The channel is completed as designed from the highway bridge at Mystic down to and including the first bend, being 15 feet deep at mean low water, and 100 feet wide, with greater width at the bends; at the second bend the channel is about 100 feet wide; at the third and fourth bends, opposite Sixpenny Island, no work has yet been done; at and above the fifth or lowest bend it has been widened from 25 to 75 feet; it was contemplated widening about 50 feet more at the point of the bend, but ledge rock was encountered, and further work at this bend will be deferred for the present, the existing width being sufficient, with careful use, to accommodate the present navigation.

PROPOSED OPERATIONS.

With the available funds, and under the arrangement now in force, it is proposed to complete reducing the second bend below the railroad bridge, and to begin work upon the point of the third bend; further appropriations will be applied to widening and reducing the other bends in the channel and to maintaining the channel already dredged, as provided in the approved project for improvement.

The average annual cost of maintenance of channels in Mystic River is estimated at $2,000.

Appropriations for the improvement of Mystic River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging above and just below railroad bridge and at mouth of stream	Sept. 19, 1890	$10,000
Dredging from railroad bridge to bend below Quarry Wharf (partly unexpended yet)	July 13, 1892	10,000
Total		20,000

Mystic River is in the New London collection districts of which New London is the port of entry.

The nearest work of defense is Fort Griswold, New London Harbor, about 6 miles west. There is a light-house on Morgan Point, on the west side of the river, at its mouth.

Money statement.

July 1, 1892, balance unexpended	$225.60
Amount appropriated by act approved July 13, 1892	10,000.00
	10,225.60
June 30, 1893, amount expended during fiscal year	6,576.57
July 1, 1893, balance unexpended	3,649.03
July 1, 1893, amount covered by uncompleted contracts	3,280.56
July 1, 1893, balance available	368.47
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

Abstract of proposals for dredging in Mystic River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1893.

No. of bid.	Name and address of bidder.	Rate per cubic yard (scow measurement).	Amount of bid (25,000 cubic yards).	Remarks.
		Cents.		
1	Simon C. Fraser, New London, Conn			
2	Elijah Brainard, New York City	19	$4,750	
3	Hartford Dredging Co., Hartford, Conn	14.3	3,575	Lowest bid.

Abstract of contract for improving Mystic River, Connecticut, in force during the fiscal year ending June 30, 1893.

Name and address of contractor.	Subject of contract.	Date of contract.	Price per cubic yard.	Remarks.
			Cents.	
The Hartford Dredging Company, Hartford, Conn.	Dredging ...	Oct. 10, 1892	14.3	Contract completed December 3, 1892, 25,975 cubic yards removed.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1891, MYSTIC RIVER, CONNECTICUT, INCLUDING VILLAGES OF MYSTIC AND NOANK.

Vessels arriving and departing.

[Draft from 7 to 12 feet.]

Vessels.	Number.	Total round trips.
Steamers	134	386
Sailing vessels	39	39
Barges for coal and other freight	21	505
Total	194	930

Freight by water.

Kind of freight.	Tons.	Estimated value.
Coal	6,508	$26,000
Lumber (350,000 feet)	525	6,500
Stone*	22,723	14,000
Miscellaneous	2,242	27,000
Total	31,998	73,500

* The stone is reported for the fiscal year ending June 30, 1892.

A statement of commerce for the year 1892 has not yet been received; it presumably varies little from that for the previous year.

No new lines of transportation have been established since July 1, 1892.

D 2.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

This river is formed by the confluence of the Yantic and Shetucket rivers at Norwich, Conn., and extends southward as a tidal stream 15 miles to Long Island Sound. For 11 miles above its mouth the natural channel is from 13 to 80 feet deep, averaging over 30 feet for the first 4 miles. For 3 miles below Norwich the available depth in 1829 was but 6 feet at mean low water, where now there is 11 feet. Histories of the improvements of this river near Norwich, Conn., may be found in the Annual Reports of the Chief of Engineers for 1873, p. 981, and in that for 1879, Part I, p. 331.

Shaws Cove, New London Harbor, is a cove on the west side of Thames River, about 2 miles above its mouth, and constitutes the southern water front of the business portion of the city of New London. It is separated from the river by the embankment and trestle of the Shore Line Division of the New York, New Haven and Hartford Railroad, having a draw of 55 feet width. The natural depth in Shaws Cove was from 2½ to 8 feet at mean low water in a narrow and crooked channel bordered by flats.

The mean rise of tide in the Thames River near Norwich is about 3.1 feet; at New London it is 2.5 feet.

PROJECTS FOR IMPROVEMENT.

Prior to 1830 various attempts had been made by private parties or corporations to deepen the channel of this river near Norwich; the first ones were by excavation only, but subsequently stone piers were constructed perpendicular to the channel at shoal spots.

By act of March 2, 1829, Congress appropriated $150 "for making a survey of the river Thames, with a view to improve the navigation of the same, and the cost of such improvement."

The survey was made in 1829 by Capt. Hartman Bache, Corps of Engineers. At that time there were four old piers standing. In his report upon the survey, dated February 20, 1830, and printed in House of Representatives War Department Doc. No. 125, Twenty-first Congress, first session, Capt. Bache submitted a project for making a channel 60 feet wide, to be either 12 or 14 feet deep at high water (9 or 11 feet at

low water), by excavation, by rebuilding one of the existing piers, by adding wings to the other three, extending up and down stream, and converting them into T walls, and by building ten new piers, extending downstream in curves. The piers were to be built of riprap, 3 feet wide on top, with side slopes of 45°; they were to be built to heights of from 1½ to 3½ feet above highest tide, those farthest up the stream being the highest. The piers were estimated to require 43,436 cubic yards of riprap and the excavation was placed at 27,895 cubic yards for the 12-foot channel, or 69,251 cubic yards for the 14-foot channel. The cost of the whole work was estimated at $72,650.

The project was adopted, and under appropriations of 1836, 1837, and 1838, $40,000 in all, the piers were built nearly as designed, with the exception of two of the new piers and one wing wall, which were not constructed; considerable dredging was done, but no complete records of amount appear to have been kept.

Work was stopped in 1839 by exhaustion of appropriations.

In 1866 a petition of citizens of Norwich, asking for an appropriation for removing obstructions in the river Thames, was referred to the Chief of Engineers, and returned by him to the Secretary of War with a report describing the work done upon the river, recommending no further work upon the piers until their efficiency could be investigated satisfactorily, and stating:

In conclusion, it is considered that should the sum of $8,000 be appropriated for the improvement of this river, to be applied during the next fiscal year, all will be accomplished that can be justifiably undertaken until a commission decides upon other efficacious methods or systems of improvement.

June 23, 1866, an appropriation of $10,000 was made for improving the river, under which a survey was made, and a project for dredging to obtain 11 feet at low water (14 feet at high water) was adopted.

Under this and succeeding appropriations up to 1878, this channel was dredged, and, as far as possible, maintained with a width of 100 feet. March 3, 1879, $12,000 was appropriated "for the improvement of Thames River to secure a 14-foot channel," and in accordance therewith the project was modified to provide for a channel of that depth at low water.

In 1882, upon the recommendation of Major Barlow, approved by the Board of Engineers, the project was further modified by providing for the construction of 5 dikes or training walls along the outer sides of the channel curves, with the addition of low walls on the inner sides, should they be found necessary, the width of the waterway between them increasing from 300 feet (about the full width of the river) at Thamesville, 1 mile below Norwich, to 480 feet at the lower dike.

The object of the training walls was to utilize the action of the tide to keep the channel open. They were to be built up to high-water level and to have an aggregate length of 13,800 feet. In the same year the projected width of the channel was increased to 200 feet. The improvement was designed to extend over the first 3½ miles below Norwich, and the estimated cost was:

For the five dikes or training walls	$82,800
For dredging 200 feet wide and 14 feet deep	125,280
Total	208,080

Under several appropriations up to 1888 work was carried on under this project without modification.

In May, 1888, in response to a letter from the Hon. Charles Russell,

M. C., to the Secretary of War, asking the "approximate cost of completing the 16-feet-deep channel to Allyn Point, and the 14-feet-deep channel to Norwich," estimates for the same were submitted as follows:

For securing, by dredging, a 16-foot channel up to Allyn Point	$24,000
For securing, by dredging, a 14-foot channel from Allyn Point to the end of the existing improvement	16,200

By act of Congress of August 11, 1888, an appropriation of $50,000 was made for continuing the improvement of Thames River, with a clause authorizing its expenditure "at any point between Norwich and New London." The project was therefore extended to include the above-described work, and as then adopted it consisted in making and maintaining, by dredging and a system of training walls, a channel 200 feet wide from New London to Norwich, having 16 feet depth at low water up to Allyn Point, about 5 miles below Norwich, and 14 feet from Allyn Point to Norwich.

The additional cost of the extension of the project made in 1888 (about $40,000) made the estimate for completion $95,600. The estimated cost of annual maintenance should also be increased to $8,000.

Under this project, up to July 1, 1892, 389,558 cubic yards of sand, etc., had been dredged from the channel above Allyn Point, and 84,890 cubic yards of sand and mud from the 16-foot channels at and below Allyn Point. The three dikes farthest downstream had been built and a fourth one to about three-quarters its contemplated length.

By act of Congress approved September 19, 1890, an examination of Shaws Cove, New London Harbor, was ordered, which was made in the same year, and the report upon which, dated December 4, 1890, was printed in House Ex. Doc. No, 73, Fifty-first Congress, second session, and also in the Annual Report of the Chief of Engineers for 1891, p. 833, *et seq.*

This report stated the desired improvement, which consisted in making a channel 100 feet wide and 12 feet deep at mean low water, extending from the drawbridge along the north and west sides of the cove a total length of about 2,000 feet, and an anchorage basin in the bend of the channel of the same depth and about 400 by 800 feet.

The estimated cost was:

Dredging the channel, 90,000 cubic yards, at 18 cents	$16,200
Dredging the anchorage basin, 140,000 cubic yards, at 18 cents	25,200
Contingencies, etc	6,600
Total	48,000

The river and harbor act approved July 13, 1892, appropriated $30,000 for improvement of Thames River, Connecticut, with proviso that $10,000 of this sum might, in the discretion of the Secretary of War, be applied to improving that part of New London Harbor known as Shaws Cove. The expenditure of $10,000 for this work was approved by the Secretary of War July 23, 1892, in order to carry out part of the above plan of improvement.

This increases the estimate for completion at the present time by $48,000, less the $10,000 already applied to Shaws Cove, making the total present estimate for completion $93,600.

Harbor lines for Shaws Cove, New London Harbor, were established by the Secretary of War January 26, 1893, under the provisions of act of Congress approved September 19, 1890.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act approved July 13, 1892, appropriated $30,000 for improving Thames River, with the proviso that "Ten thousand dollars may, in the discretion of the Secretary of War, be applied for improvement in that portion of New London Harbor known as Shaws Cove." The application of $10,000 to improving Shaws Cove was approved by the Secretary of War July 23, 1892.

After due advertisement, proposals for dredging in Thames River near Norwich, Conn., were received, and under date of October 10, 1892, with approval of the Chief of Engineers, dated October 20, 1892, a contract was entered into with the Hartford Dredging Company, of Hartford, Conn., the lowest bidders, to do the required dredging at the rate of 24½ cents per cubic yard of material. Work under this contract was begun May 12, 1893, and up to the close of the fiscal year 37,300 cubic yards of sand had been dredged from the channel, extending the 14-foot depth from Mohegan to Perch Rock, and removing shoals near Norwich. Work is still in progress.

Proposals for dredging in Shaws Cove, New London Harbor, were received, and a contract, dated October 10, 1892, approved by the Chief of Engineers October 20, 1892, was entered into with the Hartford Dredging Company to do the required dredging at the rate of 16.3 cents per cubic yard. Work under this contract was begun November 5, 1892, and completed May 10, 1893, 52,120 cubic yards of sand having been dredged; 3,290 cubic yards were dredged outside the railroad drawbridge to deepen the approach to the cove; the channel along the north and west sides of the cove was dredged to 60 feet width, and the bend of the channel was widened 200 feet, forming part of the proposed anchorage basin; depth made 12 feet at mean low water.

PRESENT CONDITION OF IMPROVEMENT.

Of the five dikes or training walls provided for in the project the four farthest downstream have been built at cost as follows:

	Date of completion.	Length.	Riprap, exclusive of repairs.	Cost, exclusive of supervision.
		Feet.	*Tons.*	
Mohegan, 3¼ miles below Norwich	1883	2,988	(*)	$23,686.00
Trading Cove, 2½ miles below Norwich	1882	2,370	17,207	21,113.05
Long Rock, 2 miles below Norwich	1885	2,800	11,945	12,781.15
Rolling Mill, 1½ miles below Norwich	1887	3,093	16,521	18,772.58

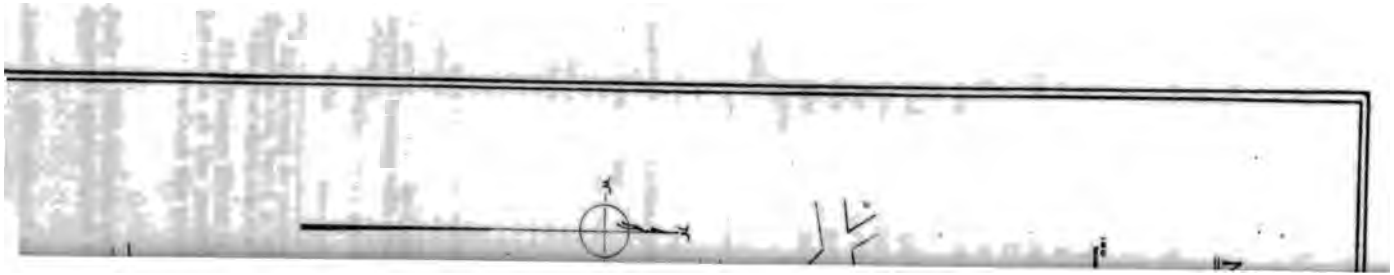
* Pile dike.

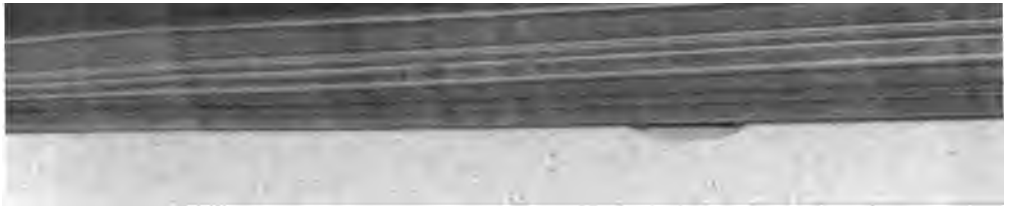
The Rolling Mill Dike, originally designed to be 4,350 feet long, is now 3,093 feet long, with a gap of 390 feet at the "sand pier," and extends northward nearly to the Lower Rolling Mill embankment.

The project contemplated extending it about 600 feet north of the embankment, but since its adoption the Lower Rolling Mill Company has dredged a channel toward shore on the north side of their embankment, which is now used as a landing. It would be necessary to leave an opening for this channel, and probably it will be found expedient not to extend the dike above the embankment.

The upper dike, one-half mile below Norwich, has not been begun.

The low-water depth in the channel from New London to Allyn Point is not less than 16 feet, with width of 200 feet or over; from Allyn Point to the upper end of Walden Island Reach the depth is practi-





cally 14 feet and the width not less than 175 feet; above the latter point up to Norwich the depth is 11 feet or over and the width from 75 feet to 150 feet.

The condition of channel in Shaws Cove is as described above, the operations during the past fiscal year being the only public improvement ever made in this part of Thames River.

PROPOSED OPERATIONS.

Future appropriations will be applied to completing the dikes, if necessary, and to making and maintaining a channel 200 feet wide, to be 16 feet deep at mean low water up to Allyn Point, and thence to Norwich to be 14 feet deep, and to completing the channel and anchorage basin in Shaws Cove, as provided in the approved project.

In order to provide for completing the work in Shaws Cove, the beginning of which was authorized by act of Congress approved July 13, 1892, and approved by the Secretary of War July 23, 1892, it is necessary to increase the estimate for completion of the project $55,600 by the amount estimated for the work at Shaws Cove, $48,000, less the $10,000 already applied to that work, making the estimated cost of completing the entire project $93,600.

Appropriations for the improvement of Thames River have been made as follows:

Application.	Date.	Amount.
Removal of obstructions placed during the war of 1812	Mar. 3, 1821	$150
Survey	Mar. 2, 1829	150
Piers and dredging	July 4, 1836	10,000
Do	Mar. 3, 1837	20,000
Do	July 7, 1838	10,000
Dredging and survey	June 23, 1866	10,000
Dredging	Mar. 3, 1867	72,000
Do	Mar. 3, 1871	15,000
Do	June 10, 1872	10,000
Do	June 18, 1878	10,000
Do	Mar. 3, 1879	12,000
Do	June 14, 1880	22,500
Dredging and training walls	Mar. 3, 1881	30,000
Training walls	Aug. 2, 1882	*35,000
Do	July 5, 1884	*25,000
Training walls and dredging	Aug. 5, 1886	*22,500
Repair of training walls and dredging	Aug. 11, 1888	*50,000
Dredging	Sept. 19, 1890	*20,000
Dredging (partly unexpended yet)	July 13, 1892	†30,000
Total		404,300

*Appropriated for present project; these, with $20,000 from previous appropriations (see Annual Report for 1882, Part I, p. 603), make a total of $172,500 for present project.
†$10,000 of which was applied to Shaws Cove, New London Harbor.

The Thames River is in the collection district of New London. The nearest lighthouse is at the mouth of the river, on the west shore. Forts Trumbull and Griswold overlook the mouth of the river from either shore.

Money statement.

July 1, 1892, balance unexpended		$4,540.95
Amount appropriated by act approved July 13, 1892		30,000.00
		34,540.95
June 30, 1893, amount expended during fiscal year		10,489.50
July 1, 1893, balance unexpended		24,051.45
July 1, 1893, outstanding liabilities	$9,244.36	
July 1, 1893, amount covered by uncompleted contracts	9,236.50	
		18,480.86
July 1, 1893, balance available		5,570.59

Amount (estimated) required for completion of existing project..... $93,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Thames River, near Norwich, and Thames River at Shaws Cove, New London Harbor, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City September 26, 1892.

No. of bid.	Name and address of bidder.	Thames River, near Norwich.		Thames River at Shaws Cove, New London Harbor.		Remarks.
		Rate per cubic yard, scow measurement.	Amount of bid, 70,000 cubic yards.	Rate per cubic yard, scow measurement.	Amount of bid, 45,000 cubic yards.	
		Cents.		*Cents.*		
1	Simon C. Fraser, New London, Conn.			30	$13,500.00	
2	Elijah Brainard, New York City.	28	$19,600.00	17⅔	7,987.50	
*3	Hartford Dredging Co., Hartford, Conn.	24½	17,150.00	16 5/11	7,335.00	Lowest bid.

* Entered into contract October 10, 1892; work in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

These have been solicited but have not yet been received.
The report for the calendar year 1891 showed the freight received and shipped, above New London only, as 609,568 tons.

D 3.

IMPROVEMENT OF CONNECTICUT RIVER, MASSACHUSETTS AND CONNECTICUT.

This river rises in the northern part of New Hampshire, flows in a generally southerly course between the States of New Hampshire and Vermont, crosses the States of Massachusetts and Connecticut, and empties into Long Island Sound at Saybrook Point, Conn. It is divided naturally into two parts, Hartford, Conn., at the head of navigation, being the point of division, and appropriations by Congress have generally specified in which part the money appropriated was to be expended.

The divisions are as follows:

1. *Above Hartford, Conn.*—Embracing a length of about 66 miles, from Hartford, Conn., to Miller Falls, Mass.

2. *Below Hartford, Conn.*—Embracing a length of about 50 miles, from Hartford to Long Island Sound.

By the river and harbor act of 1882 an examination or survey of the Connecticut River from Bellows Falls, Vt., to Pittsburg, N. H., was authorized. Bellows Falls is about 105 miles above Hartford, and Pittsburg is 180 miles above Bellows Falls. A preliminary examination was made, the report on which, printed in the Annual Report of the Chief of Engineers for 1884, Part I, p. 659, recommended no survey and proposed no plan of improvement.

1. ABOVE HARTFORD, CONN.

Miller Falls, Mass., is at the head of possible navigation of the Connecticut River. From this point down to Holyoke, Mass., a distance of about 32 miles, the river is susceptible of improvement, but it can not be used by vessels now, on account of a dam and falls at Holyoke, which entirely obstruct navigation. The lockage required to lift boats from the lower to the upper levels at Holyoke is about 60 feet.

From Holyoke, Mass., to Enfield Falls, Conn., a distance of 18 miles, there is a fair channel, 4 to 5 feet deep at low water, which could be made 8 feet deep. Enfield Falls or Rapids cover a stretch of river about 5 miles long, having a fall of about 32 feet at low water. The bed is rocky and very uneven, and the slope is not uniform, but consists of a succession of long shallow reaches separated by rapids.

From the foot of Enfield Falls to Hartford, a distance of 11 miles, the river has a broad, sandy bed, with a depth of 2 to 5 feet at low water. Under a charter from the State of Connecticut, granted in May, 1824, the Connecticut River Company has constructed a canal with locks around Enfield Falls. The locks are 80 feet long, 18 feet wide, and 4½ feet deep. The canal is chiefly used for water power; the company collects toll from vessels using it.

Following is a list of places in this part of the river where work has been done by the United States, with distances above the wagon bridge at Hartford:

	Miles.
Barbers Landing	4
Farmington River	5
Strongs Island	6½
Scantic River	7½

PROJECT FOR IMPROVEMENT.

No general project for the improvement of this part of the river is on record as approved and adopted. All the work done has been under special projects for expenditure of the several appropriations. It consists of dredging at Barbers Landing in 1873, and construction of dikes or wing dams at Scantic River, Strongs Island, and Farmington River in 1871; at Farmington River and Barbers Landing in 1878, and again in 1880 and 1881.

Plans and estimates for a larger canal around Enfield Falls were submitted in 1878 and modified in 1880 (see Annual Report of the Chief of Engineers for 1881, Part I, p. 566). They proposed a canal on the east bank of the river, extending from above Enfield Falls down to the mouth of the Hockanum River, opposite and just below Hartford, as the best means of gaining an available depth of 8 feet from Hartford to and around the falls. The canal levels were to be 10 feet deep at low water and 120 feet wide at the water line; the locks 200 feet long, 55 feet wide, with 8 feet depth over the miter sills at low water. The cost of the work was estimated at $1,332,805. It was considered not advisable to begin construction with a less sum than $450,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

No work was done. The available money is insufficient to begin any general plan of improvement in this part of the river.

PRESENT CONDITION OF IMPROVEMENT.

The wing dams are all in fair condition; they are as follows: One at Scantic River, one at Strongs Island, one at the mouth of Farmington River, two nearly opposite the mouth of Farmington River, and two on the east bank, opposite Barbers Landing. The available channel depth from Hartford to Scantic River is about 2 feet at ordinary summer stage of water; this part of the river is navigable for freighting only when in freshet. No work has been done above Scantic River; the depth from there to the foot of Enfield Falls is greater than from there down to Hartford.

PROPOSED OPERATIONS.

No work in the river above Hartford is contemplated during the ensuing year. Should any injury to the wing dams occur the money available will be sufficient for repairs.

Appropriations for improving the Connecticut River above Hartford have been made as follows:

Application.	Date.	Amount.
Dams at Scantic River and Strongs Island, Farmington River, and Barbers Landing; repairs of dams; dredging at Barbers Landing; surveys.	July 11, 1870	$30,000
	Mar. 3, 1871	20,000
	June 10, 1872	25,000
	Mar. 3, 1873	20,000
	June 14, 1880	15,000
Total		100,000

Of these amounts the following balance is yet unexpended: From the appropriation of June 14, 1880, for "improving Connecticut River between Hartford and Holyoke," $8,940.30.

Money statement.

July 1, 1892, balance unexpended	$8,940.30
July 1, 1893, balance unexpended	8,940.30

2. BELOW HARTFORD, CONN.

The Connecticut River below Hartford is a large stream, for the first 21 miles flowing in a winding course mostly through alluvial meadows, which are overflowed at high water and which consist of a light sandy soil easily undermined. For the remaining 29 miles to Long Island Sound, at Saybrook Point, the course is straighter, the banks more permanent, and generally harder. A gauge has been established at Hartford whose zero is the lowest stage that the water is known to have reached from natural causes; closing the gates at the Holyoke Dam in time of drought has caused the water to fall lower.

The usual low-water stage of the river in the summer is about 1 foot on this gauge. Spring freshets ordinarily rise to 20 feet; the highest recorded stage of water is 29 feet.

The average tide at Saybrook is 3½ feet; at Hartford it is 1 foot, though when the water stands above 5 feet on the Hartford gauge the tide there is not perceptible. The slope of the river from Hartford to Saybrook averages 0.0458 foot per mile. The bed of the river through the alluvial meadows within 10 miles of Hartford is constantly chang-

ing from the undermining of the banks. It is said that in places it has changed its position a half mile. The bars in this part of the river, after being dredged, form again during freshets and ice jams, so that some of them require being dredged annually, others less frequently. This part of the river was worked upon by corporations and by private parties at various times between 1800 and 1870. Several small stone piers to deepen the channel at shoal places were built in this way. Some of these are covered by new banks, the channel has shifted to the opposite side of others, and others still have been dredged out because they had become to be obstructions. The depth sought by these works was 6 feet at low water.

The following list gives the names of the several places on the river below Hartford where work has been done by the United States, with their distances by course of channel below the Hartford wagon bridge:

Locality.	Miles.	Locality.	Miles.
Hartford Bar	1½	Haddam Island Bar	30
Clay Banks Bar	2½	Chester Rock	38
Pratt Ferry, or Naubuc Bar	5½	Brockway Bar	41
Press Barn Bar	6½	Calves Island Bar	44½
Glastonbury Bar	9½	Saybrook Bar (at mouth)	50
Dividend Bar	12	Sears Shoal	26
Pistol Point Bar	15	Devils Reef Bar	39½
Mouse Island Bar	20½		

PROJECTS FOR IMPROVEMENT.

By act of July 4, 1836, Congress appropriated $20,000 "for improving the harbor at Saybrook, by removing the bar at the mouth of the Connecticut River." Under this appropriation a survey was made by Capt. W. H. Swift, United States Engineer Corps. In his report on this survey, dated January 31, 1837, and printed in House Ex. Doc. No. 252, Twenty-fifth Congress, Capt. Swift submitted a project for deepening the west channel over Saybrook Bar, dredging a cut 500 feet wide and 12 feet deep at mean low water, at an estimated cost of $54,380.50. The estimated cost per cubic yard for dredging and dumping was 25 cents. The available depth over the bar before dredging was 7 feet at mean low water. Capt. Swift's project was approved, and work was begun in May, 1838, under a contract with Randall, Haskell & Holmes, at the rate of 62½ cents per cubic yard, measured in scows. Dredging was continued until the fall of 1840, when the appropriation was exhausted. Twenty-six thousand nine hundred and eighty-four cubic yards of sand and stones had been removed, making a channel 1,500 feet long, 50 feet wide, and from 11 to 12 feet deep. This channel was nearly destroyed by storms and freshets in the following winter and spring. March 1, 1843, $3,471.57 was appropriated to pay a balance due to the contractors.

No further work was done upon the river until 1867.

By act of Congress approved March 2, 1867, a survey of the river was ordered, which was made in the following season, and which embraced all the principal bars and obstructions between Hartford and Long Island Sound. With the report on this survey, dated January 11, 1868, and printed on page 754 *et seq.*, of the Annual Report of the Chief of Engineers for 1868, was presented a project for improving this part of the river. It proposed dredging at Hartford, Clay Banks, Pratts Ferry, Glastonbury, and Pistol Point to make channels 8 feet deep at low

water and 100 feet wide; dredging at Saybrook Bar to make a channel 8½ feet deep and 200 feet wide; piling for shore protection at Hartford and Wethersfield, and the removal of Chester Rock, at a total estimated cost of $70,000. An estimate of $10,000 for annual maintenance was submitted. All the dredging done up to 1880 was in accordance with this project, extended to make 9 to 9½ feet depth instead of 8 feet, and also to include Press Barn, Dividend, and Mouse Island bars. The piling at Hartford was built in 1871 and the removal of Chester Rock was begun in the same year, but abandoned by the contractor soon after beginning.

January 22, 1873, a project for building three jetties at Saybrook and for dredging was approved by the Secretary of War. The jetties were to be of a double row of piles, 20 feet apart, filled with stone to a height of 8 feet above low water. The dredging was to be 9 feet deep and 400 feet wide.

The estimated cost was:

Dredging	$17,850
Jetties	318,760
Total	336,610

Before work on the jetties was begun the plan of construction was modified to one for building them of riprap stone, triangular cross-sections rising to a level of highest water, *i. e.*, about 5 feet above mean low water, this plan being much more economical than the previous one.

The jetties were begun in 1873, and two of them were completed in 1881. The third has not been built and may not be needed; the west jetty has since been extended, and both have been repaired and strengthened.

In 1880 a project was adopted for permanent works of improvement at six of the worst bars (see Annual Report of the Chief of Engineers for 1880, Part I, p. 396 *et seq*). This project provided for riprap wing dams, mattresses, shore protection, and rectification of the banks at the following places, viz:

Locality.	Amount.	Locality.	Amount.
Hartford Bar	$33,464	Glastonbury Bar	$114,922
Clay Banks Bar	69,116	Dividend Bar	7,110
Pratts Ferry, or Naubuc Bar	64,735		
Press Barn Bar	41,140	Total	330,487

with dredging to make and maintain a permanent channel. The project did not provide for extension and repair of the Saybrook jetties, nor did the estimates include any amount for annual dredging to maintain channels, nor for dredging between the jetties at Saybrook, nor for any work whatever at Pistol Point, Mouse Island, Haddam Island, and Calves Island Bars, where dredging has since been required. All of these have consumed a large part of the appropriations made since.

Under this project, extended as above, up to the fall of 1887, a training wall of riprap 3,689 feet long had been built at Hartford Bar (instead of the proposed wing dam), and a riprap wing dam 5,300 feet long had been built at Glastonbury Bar, both to a height of 3 feet above low water; part of the Hartford training wall was subsequently built to 4 feet above low water; the west jetty at Saybrook had been extended to the 16-foot curve, the east jetty to the 12-foot curve, and a channel

of 130 feet wide and 12 feet deep had been dredged between them, besides maintaining the required depths in this part of the river by annual dredging, at a cost of from $5,000 to $10,000 each year.

In 1887 it had become evident that the proposed plan of permanent improvement would not materially reduce the amount of dredging annually required, and that no effectual substitute could be recommended which would not be very expensive; and in December, 1887, a new project was adopted, under which future operations were to be confined to completing the jetties at the mouth of the river to a height of 5 feet above high water, with a top width of 6 feet, widening the channel between the jetties to 400 feet, with a depth of 12 feet at mean low water, and annual dredging to maintain the channel from Hartford to Long Island Sound, at an estimated cost as follows:

For completing jetties	$60,000
For dredging between jetties	20,000
Total	80,000
For average annual maintenance of channel from Hartford to Long Island Sound	10,000

The reasons for this change of project are fully given in a letter printed in the Annual Report of the Chief of Engineers for 1888, Part I, pp. 536–538.

In 1889 a modification of this project was adopted which provides for raising the dike at Hartford to a height of 15 feet above low water, at an estimated cost of $50,000, making the total estimate for completion at that time $130,000. The reasons for this modification are given in detail in letters to the Chief of Engineers of October 14 and October 24, 1889, printed in the Annual Report of the Chief of Engineers for 1890, Part I, pp. 614, 615.

Since the modification of the project for dredging, approved by the Chief of Engineers December 22, 1887, 254,839 cubic yards of material have been dredged up to July 1, 1892, from the several bars of the river, practically all in pursuance of that part of the project relating to annual maintenance of channel from Hartford to Long Island Sound. The amount expended on this work during this time was about $31,000.

Up to July 1, 1892, nothing had been done towards raising the dike at Hartford, the available funds at no time having been in excess of what was required for annual maintenance of channels.

The river and harbor act approved September 19, 1890, provided for examination of the Connecticut River from Long Island Sound to Hartford, and below Hartford, Conn. The report upon the examination dated December 4, 1890 (printed as House Ex. Doc. No. 86, Fifty-first Congress, second session; and also in the Annual Report of the Chief of Engineers, for 1891, p. 836, *et seq.*), mentioned the further improvements desired, and stated that all which appeared worthy to be undertaken by the United States could properly be done within the approved project and estimates for annual maintenance of channels.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Under the appropriation of $20,000 made for improving this river by the act of Congress approved July 13, 1892, dredging has been done under open market transaction with C. C. Goodrich, at the rate of 12 cents per cubic yard, approved by the Chief of Engineers, July 18, 1892. Work was begun July 23, 1892, suspended for the winter on October 28, 1892, resumed June 6, 1893, and is still in progress.

Following is a statement of amounts dredged from the several bars under this arrangement during the fiscal year ending June 30, 1893:

Localities.	Dates.	Cubic yards.
Press Barn Bar	July 28–Aug. 3, 1892	7,018
Clay Banks Bar	Aug. 3–Aug. 6, 1892	2,389
Sears Shoal	Aug. 8–13, 1892	2,636
Naubuc Bar	Oct. 4, 1892	200
Glastonbury Bar	Oct. 5, 1892	200
Hartford Bar	Oct. 6–12, 1892	3,221
Chester Rock Bar	Oct. 15–18, 1892	1,494
DevilsReef Bar	Oct. 18–28, 1892	6,098
Glastonbury Bar	June 6–9, 1893	3,044
Hartford Bar	June 10–24, 1893	10,115
Clay Banks Bar	June 26–30, 1893	4,899

The above dredging was done to a depth of 9 feet at extreme low water, and the channels were made generally 40 to 60 feet wide, only sufficient for the immediate needs of navigation. The work was all under that part of the project providing for annual maintenance of the channel.

Present condition of improvement.—The condition of the bars for the first 20 miles below Hartford was found to be about as usual when the spring freshets began to subside, the available depths when reduced to low water being from about 5 to 9 feet; the required depth has been made on these bars as soon as possible after the freshets passed, and work is still in progress.

PROPOSED OPERATIONS.

Future appropriations will be applied first to annual dredging to maintain a channel of 9½ feet depth at low water, and when sufficient funds are available, to completing the dike at Hartford, enlarging the Saybrook jetties and dredging between them. Since the plan of rating annual dredging as of first importance has been adopted, the navigable condition of the river has been much better maintained than ever before. To do this work promptly and effectively, it is necessary that about $10,000 should be available for each year, to be expended as soon as practicable after the spring freshets subside.

Enlarging the Hartford Dike is important as a means of reducing the amount of dredging annually required at Hartford Bar; and the widening of the channel at Saybrook and enlarging of the jetties there are designed to afford an easier and safer entrance to the mouth of the river.

Appropriations for improving the Connecticut River below Hartford have been as follows:

Application.	Date.	Amount.
Dredging at Saybrook Bar	July 4, 1836	$20,000.00
Dredging at Saybrook Bar (the unexpended balance of 1836 was reappropriated)	Mar. 3, 1839	
Balance due contractor under previous appropriation	Mar. 1, 1843	3,471.57
Survey	Mar. 2, 1867	3,985.23
Dredging at Pratt Ferry, Pistol Point, Mouse Island; piling at Hartford	July 11, 1870	20,000.00
Dredging at Hartford, Clay Banks, Pier I, Pier J, Pratt Ferry, Glastonbury, Pistol Point, and Chester Rock	Mar. 3, 1871	35,000.00
Dredging at Pratt Ferry, Pistol Point, and Saybrook Jetty	June 10, 1872	40,000.00
Dredging at Hartford, Pratt Ferry, Glastonbury, Saybrook Jetty	Mar. 3, 1873	30,000.00
Dredging at Hartford, Pratt Ferry, Saybrook, Saybrook jetties	June 23, 1874	30,000.00
Dredging at Hartford, Pratt Ferry, Glastonbury, Saybrook jetties	Mar. 3, 1875	20,000.00
Dredging at Hartford, Pratt Ferry, Glastonbury, Saybrook jetties, Salmon River dredging	Aug. 14, 1876	20,000.00
Compensation for previous dredging	1878	4,203.00
Saybrook jetties, survey from Hartford to Rocky Hill	June 18, 1878	30,000.00

Application.	Date.	Amount.
Dredging at Hartford, Press Barn, Glastonbury	Mar. 3, 1879	$10,000.00
Dredging at Hartford, Glastonbury, Saybrook jetties	June 14, 1880	10,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Glastonbury Wing Dam, Saybrook jetties	Mar. 3, 1881	30,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, and Salmon River, Hartford Dike	Aug. 2, 1882	45,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, and between Saybrook jetties; extending west jetty at Saybrook	July 5, 1884	35,000.00
Dredging at Hartford, Clay Banks, Naubuc, Press Barn, Glastonbury, Dividend, Pistol Point, and Haddam Island; repairs of Hartford Dike and Saybrook jetties	Aug. 5, 1886	26,250.00
Compensation for previous dredging	Mar. 3, 1885	4,745.43
Annual dredging at Hartford, Clay Banks, Press Barn, Glastonbury, Dividend, Brockways	Aug. 12, 1888	10,000.00
Annual dredging at Hartford, Clay Banks, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, Haddam Island	Sept. 19, 1890	12,500.00
Annual dredging upon several bars below Hartford; in progress	July 13, 1892	20,000.00
Total		440,165.22

The Connecticut River is in the collection district of Hartford. By course of river the distance from Holyoke, Mass., to Hartford, Conn., is about 34 miles, and from Hartford to Long Island Sound about 50 miles.

There is a light-house on Saybrook Point, on west shore of the river, at its mouth, and another at the end of the west jetty, besides which there are three small beacon lights in the lower part of the river, which are maintained by the United States.

Fort Trumbull, New London Harbor, Connecticut, about 16 miles east of Saybrook Point, is the nearest work of defense.

Money statement.

July 1, 1892, balance unexpended		$386.06
Amount appropriated by act approved July 13, 1892		20,000.00
		20,386.06
June 30, 1893, amount expended during fiscal year		3,646.03
July 1, 1893, balance unexpended		16,740.03
July 1, 1893, outstanding liabilities	$2,284.89	
July 1, 1893, amount covered by uncompleted contracts	12,903.12	
		15,188.01
July 1, 1893, balance available		1,552.02
Amount (estimated) required for completion of existing project		110,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		90,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Receipts and shipments by water.

Articles.	Tons.	Estimated value.
Coal	350,000	$1,140,000
Stone (mainly from Portland)	300,000	1,200,000
Miscellaneous	300,000	50,000,000
Total	950,000	52,340,000

Vessels employed in this traffic.

[Draft 7 to 12 feet.]

Vessels.	Number	Tonnage.
Owned in district:		
Steamers	14	3,500
Sail vessels	45	5,600
Barges	36	8,000
Not owned in district:		
Vessels of all kinds	90	15,500
Total	185	32,600

The total amount of freight carried on this river in 1892 is estimated, as above, at 950,000 tons, being 55,000 tons less than in 1891. The decrease is altogether in the item of stone, which was less than during any recent year previous.

No new lines of transportation have been established since July 1, 1892.

D 4.

IMPROVEMENT OF HARBOR OF REFUGE AT DUCK ISLAND HARBOR, CONNECTICUT.

Duck Island Harbor is a bay on the north shore of Long Island Sound, between headlands known as Menunketesuck and Kelseys Points, respectively on the east and west sides of the harbor. It is about 7 miles west of the mouth of the Connecticut River, and midway between the harbors of New Haven and New London. In this distance of 46 miles there is no secure harbor of sufficient size and depth to shelter any considerable part of the general commerce of the Sound. Duck Island Harbor has a large anchorage area, with depths of 16 feet or more at low tide and with good holding bottom. It is sheltered from the north by the mainland, partly sheltered from the east by Menunketesuck Point, and slightly sheltered from the south by Duck Island, an island about 900 feet long (north and south) by 300 feet wide, situated in the mouth of the harbor, rather more than half a mile west-southwest from Menunketesuck Point.

PROJECT FOR IMPROVEMENT.

Under act of Congress of August 2, 1882, a preliminary examination of this harbor was made by Col. J. W. Barlow, Corps of Engineers, the report upon which was printed in the Annual Report of the Chief of Engineers for 1884, Part I, p. 684, and in Senate Ex. Doc. No. 50, Forty-eighth Congress, first session. This report outlined two plans for improving the security of the harbor, and suggested that the adoption of a project be deferred for further consideration.

The act of Congress approved August 5, 1886, provided for a "resurvey of Duck Island Harbor on Long Island Sound, including plans, specifications, and estimates of cost for making the same a harbor of refuge." A preliminary examination, together with the recent Coast Survey charts, afforded all the information necessary without a detailed survey. In the report on this examination dated November 12, 1886, and printed (with map) in the Annual Report of the Chief of Engineers

for 1887, Part I, p. 641, the required plans, etc., were presented. They contemplated the construction of three riprap breakwaters, one extending westerly from Duck Island, one northeasterly from the island toward Menunketesuck Point and the third southwesterly from Menunketesuck Point. These would shelter an area of about 115 acres, with 16 feet depth or more at low tide in case of southeast storms with a larger area for storms from any other quarter. The harbor would have a broad western entrance with 17 feet depth and an eastern entrance between the breakwaters over 25 feet deep and about 750 feet wide. The breakwaters proposed were to be of riprap, 10 feet wide at top, which was to be 10 feet above low water level (about 6 feet above high water), with inside slopes of 1 upon 1, and outside slopes of 2 upon 3.

The estimated cost of riprap stone was as follows:

Breakwater westerly from Duck Island, 3,000 feet long	tons..	181,000
Breakwater northeasterly from Duck Island, 1,750 feet long	do...	79,000
Breakwater southwesterly from Menunketesuck Point, 1,130 feet long	do...	41,000
Total, 301,000 tons of stone, at $1.40 per ton		$421,400
Contingencies, 10 per cent		42,140
		463,540

The beginning of work under this project was approved by the Secretary of War September 27, 1890, after the first appropriation for this harbor had been made, and up to July 1, 1892, 23,462 tons of riprap sandstone had been delivered and placed in the breakwater, building 946 linear feet of the work to a height of 7½ feet above mean low water, with a top width of 5 feet. The diminished cross-section was adopted as a temporary expedient to secure a larger sheltered area at once; the work will require enlarging to make it permanent.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

By act of Congress approved July 13, 1892, $35,000 were appropriated for continuing this improvement, and after the usual advertisement, proposals for extending the breakwater were received, and under date of October 13, 1892, a contract was entered into with S. and E. S. Belden, of Hartford, Conn., to deliver and place about 34,000 tons of riprap at the rate of $0.89 per ton. Work under this contract was begun April 5, 1893, and up to the close of the fiscal year, 8,087 tons of stone had been delivered and placed, extending the breakwater by about 294 linear feet. Work is still in progress; the contract expires December 31, 1893.

PRESENT CONDITION OF IMPROVEMENT.

The present length of the breakwater is 1,240 feet; its height is 7½ feet above mean low water, with top width of 5 feet and side slopes of 1 upon 1; it contains 31,549 tons of riprap. The depth at the end of the breakwater is 16½ feet at low tide. In connection with the island itself it affords shelter from southeasterly storms for an area of about 25 acres with 15 feet (or over) low-water depth. The length of the work is hardly sufficient as yet to afford valuable shelter from southwesterly storms.

The condition of the work is generally good. In a few places, the part first built has settled slightly.

PROPOSED OPERATIONS.

Under the contract now in force, the breakwater will be extended westardly about 750 feet farther; a few slight repairs will be made to the older part of the work.

Future appropriations will be applied to extending and enlarging the westerly breakwater, and to building the other breakwaters, as provided in the approved project for this work.

Appropriations for harbor of refuge at Duck Island Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Westerly breakwater (946 feet)	Sept. 19, 1890	$25,000
Westerly breakwater (partly expended)	July 13, 1892	35,000
Total		60,000

Duck Island Harbor is in the collection district of Hartford.

The nearest light-house is at Saybrook Point, at the mouth of the Connecticut River, about 8 miles eastward. There is a light vessel on Long Sand Shoal, about 5 miles to the southeast.

Fort Trumbull, New London Harbor, 21 miles east, is the nearest work of defense.

Money statement.

July 1, 1892, balance unexpended		$1,315.10
Amount appropriated by act approved July 13, 1892		35,000.00
		36,315.10
June 30, 1893, amount expended during fiscal year		3,449.92
July 1, 1893, balance unexpended		32,865.18
July 1, 1893, outstanding liabilities	$5,252.39	
July 1, 1893, amount covered by uncompleted contracts	23,062.57	
		28,314.96
July 1, 1893, balance available		4,550.22
Amount (estimated) required for completion of existing project		403,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for constructing a breakwater at Duck Island Harbor, Connecticut, opened at Engineer Office, U. S. Army, New York City, September 26, 1892.

No. of bid.	Name and address of bidder.	Rate per ton.	Amount of bid (30,000 tons).	Remarks.
1	John A. Bouker, New York City	$1.57	$47,100	
*2	S. & E. S. Belden, Hartford, Conn	.89	26,700	Lowest bid.
3	James V. Luce, East Lyme, Conn	1.13	33,900	
4	Brown & Fleming, New York City	1.19	35,700	

*Entered into contract October 13, 1892; in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

No record of the number of vessels passing this harbor of refuge has ever been kept.

For general purposes it may be estimated as about two-thirds the number passing New Haven Breakwater, which was reported as 137,882 in 1891. The value of this commerce can not be ascertained.

The following extracts from letters received indicate that the harbor is used to some extent in its present unfinished state:

Mr. E. S. Belden, Hartford, Conn.—I would say that our barges with tugs have many times stopped there when bound west loaded to get shelter from storm.

Mr. W. I. Lewis, Grove Beach, Conn.—The little stretch of breakwater is not yet long enough to give protection to any large tows of barges, though a number of small tows have sought shelter. November 27, 1892, I saw four three-masted schooners and one sloop come into the harbor and anchor for safety, and but a few days before I saw a tug with four barges come in.

Mr. E. H. Jones, Grove Beach, Conn.—There is hardly a day when it is not used when the weather is such that vessels seek shelter. The largest number I have known to seek refuge at one time is seven.

D 5.

IMPROVEMENT OF CLINTON HARBOR, CONNECTICUT.

Clinton Harbor is on the north shore of Long Island Sound, about 10 miles west of the mouth of the Connecticut River. It consists of an open, shallow bay, and of the mouth of the Hammonasset River, a small stream which flows easterly in front of the town wharves, and empties into the bay. For three-quarters of a mile above its mouth the river is separated from the bay by a narrow strip of sand and marsh. About 1840 a breach was made through this strip half a mile above the mouth of the river, which diverted a considerable part of the tidal flow, and since then two shoals have formed, one just inside the river's mouth with 4.5 feet depth of water, and one out in the bay shortly before reaching the deep water of the Sound, with a depth of 4 feet. It is said that formerly there were depths of from 8 to 12 feet on both these bars, and that shoaling occurred soon after the breach was made.

PROJECT FOR IMPROVEMENT.

By act approved March 3, 1881, Congress authorized a survey of the harbor, which was made the same year. In his report on the survey, dated January 17, 1882, and printed in the Annual Report of the Chief of Engineers for 1882, Part I, p. 630, Col. Barlow, Corps of Engineers, submitted a project for restoring the original condition of the channel by closing the breach and by subsequently (should the increased tidal current not produce the deepening desired) dredging through the shoals to make a channel 100 feet wide and 6 feet deep at mean low water. The cost of a dike to close the breach was estimated at $3,000, and the cost of the whole project, including the dredging, at $10,000. This project was adopted in 1882, after the first appropriation for the improvement had been made.

Up to July 1, 1892, the dike had been built and repaired, but no dredging had yet been done; the depth of the channel had not materially changed since the survey. In 1893 the project was modified to make the width sought 75 feet and the total cost $8,500.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

By act of Congress approved July 13, 1892, $2,000 were appropriated for continuing the improvement. Advertisement was made for proposals for dredging to deepen the channel, under which but one bid was received for 32½ cents per cubic yard. By authority of the Chief of Engineers, this was rejected as being too high, and the work was readvertised by circular letter; the lowest bid received was that of the Hartford Dredging Company, at the rate of 28½ cents per cubic yard, and it was accepted.

Work was begun March 25 and completed May 10, 1893, 10,500 cubic yards of sand and mud being dredged, making a channel 6 feet deep at mean low water and 85 feet wide over the shoal first below the Clinton Wharves, and a channel of the same depth and 75 feet wide over the bar in the outer harbor.

PRESENT CONDITION OF IMPROVEMENT.

The channel now has a depth of 6 feet or more at mean low water with least width of 75 feet, up to the wharves.

The dike is in good condition. It will probably need slight repairs within a few years, but none are necessary now.

PROPOSED OPERATIONS.

The dike is completed as designed, and the dredged channel, now 75 feet wide, as provided for in the modified project of 1893, is sufficient for the commercial needs of the harbor; the project is completed. Slight repairs to the dike and deepening of the dredged channel may possibly be required from time to time to maintain the work.

No appropriation is required for the ensuing fiscal year.

Appropriations for improving Clinton Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Construction of dike	Aug. 2, 1882	$3,000
Repairs of dike and dredging	Sept. 19, 1890	3,500
Dredging	July 13, 1892	2,000
Total		8,500

Clinton Harbor is in the collection district of Hartford. The nearest light-house is on Faulkner Island, 8 miles southwest. Fort Hale, New Haven Harbor, 22 miles west, is the nearest work of defense.

Money statement.

July 1, 1892, balance unexpended	$1,582.75
Amount appropriated by act approved July 13, 1892	2,000.00
	3,582.75
June 30, 1893, amount expended during fiscal year	3,338.97
July 1, 1893, balance unexpended	243.78

Abstract of proposals for dredging in Clinton Harbor, Connecticut, opened at Engineer Office, U. S. Army, New York City, February 28, 1893.

No. of proposal.	Name and address of bidder.	Rate per cubic yard.	Amount of bid (15,000 cubic yards approximate).	Remarks.
*1	The Hartford Dredging Co., Hartford, Conn..	$0.32½	$4,875.00	The only bid received.

* Rejected as being too high.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Arrivals and departures of vessels		25
Shipments:		
Wood, lumber, hay, etc	tons..	3,005
Receipts:		
Coal	do...	1,200
Oysters, 7,000 bushels (equals about)	do...	450
Draft of vessels using the harbor	feet..	4½ to 7
Tonnage of vessels using the harbor	tons..	30 to 150

The above statement shows a decrease of freight since 1891 of 65 tons; as the figures given are partly estimated, the amounts may be considered practically the same.

No new lines of transportation have been established since July 1, 1892.

D 6.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

New Haven Harbor is a bay on the north shore of Long Island Sound, extending about 4 miles inland and from 1 to 2 miles wide. The Mill and Quinnipiac rivers empty into the head of the harbor; they are streams of no commercial importance, except for tidal navigation at or near their mouths.

The harbor channel is from 400 feet to a mile wide, with mud and sand flats on either side. When the Government began work in this harbor in 1867, the available low-water depth from the city wharves to Cranes Bar, about one-third way down the harbor was 9 feet; thence to Fort Hale, which is about half way down, it was 16 feet or over. A short distance below Fort Hale was a bar of very soft mud, extending across the harbor with 13 feet available depth at mean low water.

The entrance to the harbor was partially obstructed by several sunken rocks.

PROJECTS FOR IMPROVEMENT.

Several plans for removal of certain of the rocks at the harbor entrance have been proposed and undertaken, but not completed. The removal of the harbor light-house to Southwest Ledge and the completion of the proposed system of breakwaters will obviate the necessity of further work upon these rocks.

The work of deepening the channel in this harbor has, for the most part, been done in accordance with plans presented in annual or special

1875, with favorable indorsement of the Chief of Engineers. The latter plan was carried out under the appropriation of $10,000 made March 3, 1875, with a balance of about $6,000 from previous appropriations, and the 13-foot channel was made 415 feet wide above Long Wharf, the price of work being much lower than had been estimated.

Nothing was appropriated for this harbor in 1876 and 1877.

In the Annual Report for 1877 Col. Barlow refers to the estimates submitted in his letter of January 25, 1875, and recommends that the channel below Long Wharf be made 400 feet wide and 16 feet deep, its then dimensions (200 feet wide and 13 feet deep) not affording "sufficient space for convenient navigation." The estimated cost was $40,000.

In 1878, under the appropriation of $25,000 made June 14, 1878, the channel was dredged to the length and depth proposed, with width of 300 feet.

In a letter of February 4, 1879, transmitting map of harbor examination made in December, 1878 (letter printed in the Annual Report of the Chief of Engineers for 1879, Part I, p. 336), Col. Barlow recommends deepening the channel above Long Wharf and widening the channel below to secure 400 feet width, with 16 feet depth from the steamboat wharf down to Fort Hale; also dredging a channel 500 feet wide and 16 feet deep through Fort Hale Bar. The work above Fort Hale was estimated to cost $65,000; that below, $35,000. The proposed depth and slightly greater width above Fort Hale was obtained by October, 1881, under three successive appropriations of $15,000 each, made in 1879, 1880, and 1881. Nothing had been done on Fort Hale Bar.

In the Annual Report for 1879 a dike at Sandy Point (opposite Fort Hale) was suggested as a means of increasing the depth on Fort Hale Bar, but on account of its expensiveness was not recommended to be undertaken until dredging had been tried again.

In the Annual Report for 1880 (Part I, p. 445), Col. Barlow renews his recommendation for dredging a channel through Fort Hale Bar 500 feet wide and 16 feet deep.

In the Annual Report for 1881 (Part I, p. 592), after current observations and borings had been made, a dike from Sandy Point is recommended, the length to be determined experimentally as construction progresses, but to be at least 4,400 feet, which length was estimated to cost $60,000.

Under appropriation of $30,000 made August 2, 1882, a plan for this dike was submitted and referred to the Board of Engineers, by whom it was slightly modified and approved October 2, 1882.

The project, as approved, consisted of a dike connected with Sandy Point by a shore arm about 2,160 feet long and extending southward as a channel arm about 3,200 feet, the channel arm and part of the shore arm to be built of creosoted piling in double rows, filled in with stone. In 1883 the location of the shore arm was modified upon the request of oyster-growers in the vicinity, and in 1886 the method of construction was changed to use riprap instead of creosoted piling, the latter being found more expensive both to construct and to keep in repair.

The appropriations of 1882, 1886, and nearly all of 1888, were expended upon the dike, building the shore arm, and more than half of the channel arm. The appropriation of 1884 was expended in dredging under a special project for widening the channel above Long Wharf,

with depths of 8 to 12 feet, and for removing part of the old piers and abutments at Tomlinsons Bridge, which bridge was at that time being rebuilt.

The present project for making a 16-foot channel across the Fort Hale Bar includes the completion of the dike and dredging a channel 400 feet wide and 16 feet deep through the bar. Revised estimates for completion, made in 1887 (see Annual Report of the Chief of Engineers for 1887, Part I, pp. 599 and 600), placed the cost of completion at that time at $46,000 for the dike and $47,000 for the channel; total, $93,000. This is to be reduced by $45,000 since appropriated, making the present estimate for completion $48,000.

Up to July 1, 1892, the shore arm and 2,089 linear feet of the channel arm of the dike had been built. No dredging had been done on Fort Hale Bar since 1873, and the available depth there was about 13 feet at mean low water; above Fort Hale the channel had been made 16 feet deep at mean low water and from 400 to 700 feet wide.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Fifteen thousand dollars were appropriated by act of Congress approved July 13, 1892, for continuing this improvement. After due advertisement, proposals for dredging were received, and under date of October 10, 1892, a contract was entered into with Alonzo J. Beardsley to dredge about 110,000 cubic yards, at the rate of 12 cents per yard. Dredging was begun November 26, 1892, and the contract was completed April 18, 1893, 117,908 cubic yards of mud being removed from the channel opposite and above Long Wharf, widening it by from 40 to 120 feet, and removing shoal spots; the depth was made 16 feet at mean low water.

PRESENT CONDITION OF IMPROVEMENT.

The available depth over Fort Hale Bar is about 13 feet at mean low water. Above the bar there is a 16-foot channel up to Tomlinson's Bridge, at the head of the harbor, with from 400 to 700 feet width.

Of the Sandy Point Dike, the shore arm, 2,140 feet long and 2,089 feet of the channel arm (including an ice-breaker 20 feet long), have been built; 1,294 feet of the inner end of the shore arm are of riprap; the outer part of the shore arm, 846 feet long and 254 feet of the north end of the channel arm, are built of two rows of creosoted piling, 8 feet apart from out to out, and filled in with stone; 1,815 feet of the channel arm south of the pile work are built of riprap, of which the north 273 feet are on a log foundation; the ice-breaker at the north end of the channel arm is also of heavy riprap on log foundation. Parts of the dike have settled from 1 to 2 feet.

PROPOSED OPERATIONS.

Future appropriations will be applied to dredging the channel or to extending the dike, or to both. The estimated cost of completing these works is $48,000, to which should be added an estimate of $5,000, annually required for maintaining the channels and for repairs of dike.

Appropriations for the improvement of New Haven Harbor have been made as follows:

Application.	Date.	Amount.
Removal of Middle Rock, not expended until 1867	Aug. 30, 1852	$6,000
Removal of rocks	July 11, 1870	15,000
Dredging (13 feet) above Fort Hale	Mar. 3, 1871	40,000
Dredging (16 feet) Fort Hale Bar and removal of rocks	June 10, 1872	35,000
Dredging (16 feet) Fort Hale Bar	Mar. 3, 1873	25,000
Dredging (13 feet) above Long Wharf	Mar. 3, 1875	10,000
Dredging (16 feet) Long Wharf to Fort Hale	June 18, 1878	25,000
Dredging (16 feet) above Long Wharf	Mar. 3, 1879	15,000
Do	June 14, 1880	15,000
Dredging (16 feet) Long Wharf to Fort Hale	Mar. 3, 1881	15,000
Sandy Point Dike	Aug. 2, 1882	30,000
Dredging (18, 12, and 8 feet) above Long Wharf	July 5, 1884	10,000
Sandy Point Dike	Aug. 5, 1886	20,000
Do	Aug. 11, 1888	15,000
Dredging	Sept. 19, 1890	15,000
Do	July 13, 1892	15,000
Total		306,000

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 3½ miles from Long Island Sound.

There is a light-house on Southwest ledge, at the mouth of the harbor.

Fort Hale, 2 miles below the city, commands the channel.

Money statement.

July 1, 1892, balance unexpended	$718.40
Amount appropriated by act approved July 13, 1892	15,000.00
	15,718.40
June 30, 1893, amount expended during fiscal year	15,447.82
July 1, 1893, balance unexpended	270.58
Amount (estimated) required for completion of existing project	48,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	48,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in the harbor of New Haven, Conn., opened by Col. D. C. Houston, Corps of Engineers, New York City, September 27, 1892.

No. of proposal.	Name and address of bidder.	Rate per cubic yard, scow measurement.	Amount of bid (130,000 cubic yards).
		Cents.	
*1	Alonzo J. Beardsley, Bridgeport, Conn	12	$15,600
2	Charles and H. E. Du Bois, New York City	12	15,600

* Entered into contract October 10, 1892; contract completed April 18, 1893; 117,908 cubic yards removed.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Value of imports	$459,934.16
Value of exports	$995,675.00
Revenue receipts	$115,484.85
Foreign vessels entered, 54; cleared, 42	96
Domestic vessels entered, 1,049; cleared, 1,050	2,099

January 21, 1875, a resolution was passed by the House of Representatives asking "for a report from surveys already made in regard to the expediency of widening and deepening the main channel of New Haven Harbor, Connecticut, to a depth not exceeding 20 feet, and also the expediency and estimate of expense of a breakwater between the eastern shore of the entrance to said harbor and Southwest Ledge (so called), or such part of said distance as may be found most expedient or necessary for the protection of said harbor." In reply to this resolution a report was made by Col. J. W. Barlow, Corps of Engineers, dated January 27, 1875, printed in House Ex. Doc. above mentioned, and also in the Annual Report of the Chief of Engineers for 1875, Part II, p. 251, suggesting three locations for a breakwater, viz:

1. That indicated in the resolution and terminating at Southwest Ledge.
2. A line running nearly east and west, its middle point resting upon Adams Fall Rock, about one-half mile north of Southwest Ledge.
3. A line 400 yards farther north, running nearly west from Five Mile Point.

Estimates of cost, ranging from $248,000 to $465,330, were submitted, and with the report were also presented letters and commercial statistics bearing upon the subject.

The question of a westerly breakwater does not appear to have been considered at that time.

This report is referred to by Col. Barlow in the succeeding Annual Reports for 1876, 1877, and 1878, and in the latter year additional statistics were submitted; but no action was taken until 1879, when an appropriation of $30,000 was made for the "construction of a breakwater at New Haven, Conn."

In August of the same year an examination of part of the mouth of the harbor was made and a map transmitted to the Chief of Engineers with several projects for breakwaters, which were referred to the Board of Engineers for report.

The report of the Board, dated November 24, 1879, and printed in the Annual Report of the Chief of Engineers for 1880, Part I, pp. 449–452, recommended a breakwater from Southwest Ledge to Quixes Ledge, as contemplated in the resolution of the House of Representatives of January 21, 1875, but as the anchorage ground would still be exposed to southwesterly gales the Board stated as its opinion that a breakwater extending northwest from Luddington Rock would be necessary. Their plan provided for two riprap breakwaters, 12 feet wide on top, rising 6 feet above high water, with exterior slopes of 1 on 3 and interior slopes of 2 on 3, with estimates as follows:

Estimates for breakwater from Light-House Ledge to Quixes Ledge.

Length of construction	yards..	1,100
Average height of work	feet..	32
Average cross section	yards..	299
Cost per cubic yard		$2.00
328,900 cubic yards, at $2		$657,800.00

Estimates for breakwater in vicinity of Luddington Rock.

Length	yards..	1,400
Average height	feet..	28
Cross section	square yards..	233⅓
326,667 cubic yards, at $2		$653,334.00

This plan locates the easterly breakwater so as to lie between Light-House Ledge (or Southwest Ledge) and Quixes Ledge, and the westerly one to extend in a northwest and southeast direction, overlying Luddington Rock. The report of the Board was transmitted to the Secretary of War by the Chief of Engineers with the suggestion that the appropriation ($30,000) be applied toward the construction of the easterly breakwater, and was approved by him January 31, 1880. Before work had been begun the details of cross section were modified, with the approval of the Chief of Engineers, so that the exterior slope should be 1 on 2 and the interior 1 on 1.

The first load of stone was delivered April 22, 1880, beginning the east breakwater at the end resting upon Southwest Ledge. Under subsequent appropriations it was extended northeasterly and completed to and across Quixes Ledge on February 22, 1890.

The river and harbor act of 1888 provided:

> And the Chief of Engineers may, if deemed necessary, relocate the western breakwater, and the Secretary of War is authorized, in his discretion, to expend any portion of said sum in its commencement.

An examination in reference to this matter was made in the fall of 1888 and the results reported to the Chief of Engineers in a letter dated January 26, 1889, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, p. 679. In the Annual Report for 1889 (see Annual Report of the Chief of Engineers for 1889, Part I, p. 678) was presented a modification of the project adapted to the present and prospective requirements of commerce of Long Island Sound. This modification contemplated the relocation of the westerly breakwater by changing its location about 6,000 feet to the southwestward and the construction of a middle breakwater, commencing at a point 1,000 feet N. 54° E. from Luddington Rock, and extending S. 54° W. 5,000 feet, crossing the rock; and also a breakwater about 1,200 feet long, to partly close the space between Quixes Ledge and the east shore.

The cross section of these breakwaters was intended to be the same as the one from Southwest Ledge to Quixes Ledge, viz 12 feet wide on top, the top to be 6 feet above mean high water, with outer slope of 1 upon 2, and inner slope of 1 upon 1. It was estimated that this relocation of the western breakwater, including the intermediate breakwater across Luddington Rock, would increase the cost of completion ($941,135 in 1889) by about $750,000, and the construction of the breakwater at the east shore would add about $90,000 more.

By act of Congress approved September 19, 1890, $120,000 was appropriated for "constructing breakwater at New Haven, Conn., in accordance with the plans submitted by the Chief of Engineers, in Report for 1889, p. 678."

The estimated cost of this project from the beginning is, therefore ($1,311,134 + $750,000 + $90,000), $2,151,134, of which, up to July 1, 1893, $610,000 have been appropriated, and the estimated cost of completion of the project is $1,541,134.

Up to July 1, 1892, the breakwater easterly from Southwest Ledge had been completed, and the westerly breakwater across Luddington Rock had been begun; 1,980 linear feet of it being built to partial height and width, under a contract then in progress.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Under the contract with James J. Moran, dated December 20, 1890, with supplementary contracts, work was continued until December 22, 1892, when the contract was completed. During this fiscal year 13,143

tons of granite and 7,599 tons of sandstone were placed in the breakwater, extending it 236 linear feet, and enlarging the greater part of the work. The total amount of stone delivered, under this contract, was 110,026 tons, of which 77,936 tons were granite, under the original contract of December 20, 1890, and 32,090 tons were sandstone, under the supplementary contract, dated October 6, 1891. The total length of breakwater built, under the contract, was 2,216 linear feet, of which 500 feet lay northeast of the shoalest part of Luddington Rock, and 1,716 feet southwest.

The act of Congress, approved July 13, 1892, appropriated $120,000 for continuing this improvement. Proposals were received for furnishing and placing riprap to extend and enlarge the breakwater, and September 13, 1892, a contract was entered into with John Beattie to deliver and place about 110,000 tons of granite, at the rate of $1.09 per ton. Work under this contract was begun September 29, 1892, and up to the close of the fiscal year 61,179 tons of riprap had been delivered, of which 41,432 tons were applied to extending the breakwater 695 feet southwesterly, and 19,747 tons were applied to enlarging parts of the previously built work. The contract expires January 16, 1894.

The total amount of stone put into the breakwater during the fiscal year was 81,921 tons, and the total length of extension built was 931 feet.

PRESENT CONDITION OF WORK.

The east breakwater was completed February 22, 1890; it is 3,450 feet long, extending from the foundation of the light-house on Southwest Ledge northeasterly to and across Quixes Ledge, terminating in a depth of 16 feet of water at the edge of the east entrance channel. It contains 293,777 tons of riprap, and the average cost (supervision, etc., included) has been $102.50 per linear foot. The whole work is in good condition.

The breakwater crossing Luddington Rock is now 2,911 feet long, 500 feet of which lies northeast of the crest of the rock, and 2,411 feet southwest. About one-half of this work has been built fully up to the cross-section adopted temporarily—the top to be 12 feet wide at 6 feet above mean high water, with side slopes of 1 upon 1; the rest is in various stages of progress.

PROPOSED OPERATIONS.

Under the existing contract and with the available funds, the breakwater will be extended about 500 feet farther, and the whole work enlarged to dimensions as at present proposed.

Future appropriations will be applied to completing this breakwater, and to carrying out the project as adopted.

Appropriations for breakwaters at New Haven have been as follows:

Application.	Date.	Amount.
Easterly breakwater	Mar. 3, 1879	$30,000
Do	June 14, 1880	30,000
Do	Mar. 3, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	40,000
Do	Aug. 5, 1886	75,000
Completing easterly breakwater	Aug. 11, 1888	75,000
Middle breakwater	Sept. 19, 1890	120,000
Do	July 13, 1892	120,000
Total		610,000

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 4 miles north of the breakwaters.

There is a light-house on Southwest Ledge, the west terminus of the east breakwater.

Fort Hale, 2 miles north of the breakwater, commands the harbor channel.

Money statement.

July 1, 1892, balance unexpended		$52,628.91
Amount appropriated by act approved July 13, 1892		120,000.00
		172,628.91
June 30, 1893, amount expended during fiscal year		85,571.73
July 1, 1893, balance unexpended		87,057.18
July 1, 1893, outstanding liabilities	$28,477.96	
July 1, 1893, amount covered by uncompleted contracts	53,214.89	
		81,692.85
July 1, 1893, balance available		5,364.33
Amount (estimated) required for completion of existing project		1,541,134.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for construction of breakwater at New Haven, Conn., opened by Col. D. C. Houston, Corps of Engineers, New York City, August 26, 1893.

No.	Name and address of bidders.	Rate per ton of 2,240 pounds for stone.	Amount of bid (100,000 tons).	Remarks.
1	S. and E. S. Belden, Hartford, Conn..	$1.17	$117,000	Portland brownstone, and Branford granite.
2	John A. Bouker, New York City ...	1.15	115,000	Kind of stone not stated.
3	John Beattie, Leetes Island, Conn.*.	1.09	109,000	Granite.
4	Brown & Fleming, New York City..	1.17½	117,500	Kind of stone not stated.
5	James J. Moran, Brooklyn, N. Y ...	1.25	125,000	Granite.
		1.10	110,000	Sandstone or New York City stone.

* Lowest bid.

Abstract of contracts for construction of breakwater at New Haven, Conn., in force during the fiscal year ending June 30, 1893.

Name and address of contractors.	Date of contract.	Subject of contract.	Rate per ton.
James J. Moran, Brooklyn, N. Y.*	Dec. 20, 1890	Delivering riprap granite and constructing breakwater.	$1.07
James J. Moran, Brooklyn, N. Y. Supplementary to above.*	Oct. 6, 1891	Substituting Connecticut River sandstone for granite.	1.04
James J. Moran, Brooklyn, N. Y.*	Mar. 14, 1892	Enlarging work already built, using 10,000 tons of stone, at additional price of.	.10
John Beattie, Leetes Island, Conn.†	Sept. 13, 1892	Delivering riprap granite and extending and enlarging breakwater; amount about 110,000 tons.	1.09

* Contracts completed December 22, 1892; 110,026 tons.

† Contract in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Vessels passing New Haven breakwater.

Men-of-war	34
Steamers of all kinds	42,860
Steamships	2,075
Ships, barks, and brigs	1,320
Schooners and sloops	54,750
Barges in tow, scows, etc	36,500
Total	137,539

These records are not complete, as many vessels pass unobserved in night. The value of this commerce cannot be ascertained.

D 8.

IMPROVEMENT OF MILFORD HARBOR, CONNECTICUT.

This harbor is on the north shore of Long Island Sound, about 9 miles southwest of New Haven, Conn. It consists of a broad, open bay, from the head of which the Wepauwog River, a small tidal stream, extends three-quarters of a mile north to the Milford Wharves, and the Indian River, another small inlet, extends northeasterly. The mouth of the latter stream is partly closed by a dam formerly used to create power for a tide mill.

The original depth on the bar just outside the mouth of the river was less than 2 feet at mean low water, and in some places between there and the upper wharves low tide left the channels nearly bare.

The mean rise of tide is 6.2 feet.

PROJECTS FOR IMPROVEMENT.

A survey of breakwater at Milford, Conn., was ordered by Congress in the river and harbor act of 1872. There being no breakwater, a survey of the harbor was made for a breakwater, and in his report, dated December 24, 1872 (printed as part of Ex. Doc. No. 107, Forty-second Congress, third session; and also on p. 1041 of the Annual Report of the Chief of Engineers, for 1873), Gen. Warren, U. S. Engineers, submitted the following plan of improvement:

1. A riprap breakwater from Welch's Point, on the east side of the mouth of the harbor	$67,000
2. Protecting the bluffs on the east shore from erosion by means of small stone jetties	5,500
3. Dredging 4 feet deep and 100 feet wide across the bar at the mouth of the river	6,250
4. A jetty on the east side of the channel to prevent dredged area from filling, and to confine the action of the tide	5,000
Superintendence	1,250
Total	85,000

In 1874 $5,000 was appropriated for this harbor, and work under the above project was begun, building the small jetties to protect the east shore. Twelve such jetties were built, 100 to 130 feet long, and rising to 9 feet above mean low water. The appropriation of 1875 ($13,000)

was applied to the repair of these jetties, to construction of a jetty from the east shore, at the mouth of the Indian River (Long Jetty), and to dredging across the bar.

In the Annual Report for 1876 (part 1, p. 2251), Col. Barlow, U. S. Engineers, recommended that the dredged channel be carried up to Town Wharf, about half a mile farther, at an additional estimated cost of $9,000.

This recommendation was renewed in 1877, and was included in the project for expenditure of the appropriation of $10,000 made in 1878. In that and the following year the 4-foot channel across the bar was completed to 100 feet width, as originally projected, and was extended to Town Wharf, with width from 60 to 75 feet, and Long Jetty was repaired; also, under same appropriation, in 1879 and 1880, an additional jetty, authorized by Department letter of October 16, 1879, was built on the west side of the channel, extending southward from Burns Point. This appropriation completed the original project, except the breakwater; sufficient money for beginning that had not been appropriated.

June 14, 1880, $5,000 was appropriated, and in accordance with a project for its expenditure, submitted and approved, the 4-foot-harbor channel was extended from Town Wharf to the Straw Works Wharf, at the upper end of the harbor, with a width of 40 feet. This was completed before the appropriation was exhausted, and "at the earnest solicitations of those most interested in the works of improvement there an experimental channel, 25 feet wide and 8 feet deep, was cut through the bar at the entrance, lying within and on the west side of the channel already made. This is now of great use to the steam vessels employed in the fish-oil works at that place, and it is claimed that the increase of shipping in the harbor, particularly in the oyster business, for which those waters seem very well adapted, will soon require an 8-foot channel of fully 100 feet width. Such a channel would involve the removal of about 45,000 cubic yards more of material, principally sand and gravel, which, at ruling prices would cost, including superintendence and incidental expenses, about $11,000." (Extract from Col. Barlow's annual report for 1881; see Annual Report of the Chief of Engineers for 1881, Part I, pp. 598 and 599.)

Under the appropriation of $5,000 made August 2, 1882, the project above suggested was adopted, and the 8-foot channel was widened to 65 feet from the bay up to Merwin's Wharf, with 100 feet width around the bend at Burns Point. In 1889 this channel was made fully 100 feet wide, and some needed repairs to Long Jetty were begun.

By act of Congress approved March 3, 1881, a survey for a breakwater and harbor of refuge at Milford Harbor was authorized. The survey was made and a report, with estimates, was submitted January 20, 1882. This report is printed in the Annual Report of the Chief of Engineers for 1882, Part I, p. 632.

Under date of December 14, 1889, Hon. O. H. Platt, United States Senate, wrote the Chief of Engineers, requesting an examination of Milford Harbor, and a report upon dredging the channel to the upper wharves. This report was made December 31, 1889. In compliance with a resolution of the House of Representatives of January 18, 1890, a copy of the report was transmitted to the House, and printed as House Ex. Doc., No. 139, Fifty-first Congress, first session; also in the Annual Report of the Chief of Engineers for 1890, Part I, p. 629.

The act of Congress, approved September 19, 1890, appropriated

$2,500 for this improvement. This amount was estimated in previous annual reports as required for repairs of the jetties; and, with the approval of the Chief of Engineers, granite was purchased in open market to be used in widening the base of Long Jetty, at the mouth of the Indian River, the price being $2.50 per gross ton delivered and placed; 840 tons of stone were so delivered, and the entire outer side of the jetty was widened and the most exposed part of the inner side.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

Long Jetty, as now repaired and enlarged, has dimensions as provided in the project, viz, outer slope 2 upon 3, inner slope 1 upon 1. There yet remain about 300 feet of the jetty not widened on the inside.

The channel, dredged 4 feet deep, with width of 60 feet for about two-thirds the distance, from the mouth of the river to the Straw Works Wharf and with width of 40 feet for the rest of the distance, has shoaled somewhat.

The channel across the bar is 8 feet deep and over 100 feet wide.

PROPOSED OPERATIONS.

The project is completed, and nothing further is contemplated under it, except what is from time to time necessary for the maintenance of the jetties and dredged channels.

No appropriation is needed for the ensuing year.

Appropriations for Milford Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Survey	June 10, 1872	$1,500
Jetties on east shore	June 23, 1874	5,000
Long Jetty and dredging at mouth of river	Mar. 3, 1875	13,000
Dredging to Town Wharf	June 18, 1878	10,000
Dredging above Town Wharf and (8 feet) below Merwin's Wharf, on bar	June 14, 1880	5,000
Survey for breakwater	Mar. 3, 1881	100
Dredging 8 feet on bar	Aug. 2, 1882	5,000
Dredging 8 feet on bar and repairing Long Jetty	Aug. 11, 1888	5,000
Repairing jetties	Sept. 19, 1890	2,500
Total		47,100

Milford Harbor is in the collection district of New Haven; it is about 9 miles west from Fort Hale, New Haven Harbor.

The nearest light-house is on Stratford Point, 4 miles to westward.

Money statement.

July 1, 1892, balance unexpended	$175.46
June 30, 1893, amount expended during fiscal year	175.46

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR OF 1892.

Vessels arriving and departing.—Number of trips.

[Draft, 3 to 10 feet; tonnage, 10 to 200 tons.]

Steamers	1,825
Sail vessels	700
Barges	15
Total	2,540

Chief articles of commerce are:

	Tons.
Oysters, 20,000 barrels (about)	1,900
Seed oysters, 60,000 bushels (about)	1,776
Coal	3,600
Total	7,276

Estimated to be worth $150,000.

This includes no figures for the oil works at Welchs Point, at the mouth of the harbor.

No new lines of transportation have been established since July 1, 1892.

D 9.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

The Housatonic is a long, shallow river running southward through Massachusetts and Connecticut and emptying into Long Island Sound just east of Stratford Point, about 15 miles southwest from New Haven. At Derby, 13 miles above its mouth, it receives the discharge of the Naugatuck, a small, rapid river. This point, which has been regarded as the head of navigation, is nearly the head of tide water. About a mile above there is a dam across the Housatonic River, furnishing large water power. For at least 5 miles below Derby the water is always fresh.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet at mean low water; there was also a bar across the river's mouth with about 4 feet low-water depth.

PROJECTS FOR IMPROVEMENT.

In pursuance of a resolution of the House of Representatives dated December 20, 1869, authorizing a survey of the Housatonic River below Derby, which resolution was referred by the Secretary of War to the Chief of Engineers for report as to the "necessity for the survey," an examination of the river from Derby to Long Island Sound was made by Col. D. C. Houston, Corps of Engineers, who reported January 8, 1870, and recommended a detailed survey of all that part of the river, at an estimated cost of $5,000. This report was printed in House Ex. Doc. No. 62, Forty-first Congress, second session.

By act of Congress approved July 11, 1870, a survey of Housatonic River below Derby, Conn., was directed, and an allotment of $2,700 was made for a survey "sufficient to determine the prominent obstructions to navigation." In his report on this survey, dated January 23, 1871, and printed in House Ex. Doc. No. 95, Forty-first Congress, third

session, and also in the Annual Report of the Chief of Engineers for 1871, p. 781, Gen. G. K. Warren, Corps of Engineers, submitted the following estimates for making a channel 7 feet deep at mean low water, to be 200 feet wide over the bar at the mouth of the river and 150 feet wide in the river, the channel at the river's mouth to be protected on the east side by a breakwater from Milford Beach:

Jetty at Sow and Pigs Reef	$4,000
Removing Drews Rock, 357 cubic yards	2,000
Dredging inside the bar at the mouth	18,486
Dredging on the bar at the mouth	12,000
Construction of breakwater at mouth	368,475

The breakwater was to be built of riprap up to 1½ feet above mean low water and of dimension stone above; it was to be 6 feet wide on top, rising to 11 feet above low water, and was to extend to the 6-foot curve, an estimated length of 4,200 feet.

March 3, 1871, the first appropriation for improvement of the river was made, and work in accordance with the project was begun. In 1872 the project was modified to admit of a jetty connecting Drews Rock with the west bank instead of removal of the rock. This was done on the ground of economy, and the jetty was built in 1872. The result was to form a bar below the jetty, which required such frequent dredging that it was found expedient to remove the rock as originally projected. This was done in 1887–'88.

Appropriations were not made in sufficient amounts to warrant beginning the breakwater as originally designed, and in 1879 Col. Barlow proposed to substitute for it a riprap jetty, at an estimated cost of $12,000.

In 1882 the estimate was changed to $20,250, the contemplated jetty being 6,000 feet long and rising only to low-water level. Such a jetty could subsequently be built higher, if necessary, and there seemed no doubt that this would have to be done before any useful effect could be realized. Therefore, in the Annual Report for 1887 (see Annual Report of the Chief of Engineers for 1887, Part I, p. 607), Col. Houston, U. S. Engineers, then in charge, presented revised estimates for a breakwater, modifying the originally-proposed method of construction to one for using riprap only, experience at harbors on Long Island Sound having shown this construction to be as durable as dimension work and more economical.

At the same time estimates based on recent surveys for dredging, necessary to make the channel 7 feet deep, with width of 200 feet at the mouth of the river and 100 feet above, were submitted. The latter width was adopted in 1883 because up to that time the originally proposed width of 150 feet had never been obtained.

Following are the estimates for breakwater and for dredging submitted in 1887:

For a breakwater 5,750 feet long, extending from Milford Beach 3,250 feet in a course about south-southeast, thence parallel with and 500 feet from the channel 2,500 feet farther to the 12-foot curve; inside the bend to be built up to 3 feet above mean low water, top width 6 feet, side slopes 1 upon 1, outside the bend to be built up to 6 feet above high water, top width 12 feet, outer slope 1 on 2, and inner slope 1 on 1	$175,000
For dredging at the mouth of the river and at 6 bars in the river, 146,000 cubic yards, at 16 cents, with about 15 per cent added for contingent expenses	27,000
Total	202,000

to which should be *added about $4,000* annually required for maintenance of channels.

January 27, 1888, a letter further explaining the reasons for the new estimate for breakwater was submitted to the Chief of Engineers, and was subsequently printed as Senate Ex. Doc. No. 103, Fiftieth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1888, Part I, p. 554.

Up to July 1, 1892, the breakwater at the mouth of the river had been built to a length of 4,572 feet, the 3,250 feet nearest the shore end being built to half tide level and the outer 1,322 feet to 4 feet above high water, with top width of 5 feet. The available depth on the bars in the river was about 4½ feet and on the outer bar from 5 to 6 feet in a crooked channel.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Sealed proposals for dredging on the bar at the mouth of the river, invited by circular letter, were opened July 6, 1892, and with approval of the Chief of Engineers, dated July 8, 1892, the lowest bid, that of Elijah Brainard, at 24½ cents per cubic yard, was accepted. Dredging was begun July 17 and completed August 17, 1892, 18,300 cubic yards of sand being removed from the crest of the bar, making a depth of 7 feet at mean low water in a channel 132 feet wide and about 1,000 feet long where the previous depths had been from 4 to 7 feet.

The river and harbor act approved July 13, 1892, appropriated $20,000 for continuing the improvement of this river. Proposals for extending the breakwater at the mouth of the river were received, and a contract entered into under date of October 4, 1892, with Brown & Fleming, to do the required work with riprap, furnished and placed, at the rate of $1.12 per gross ton. Work was begun October 22; December 5 it was suspended on account of weather, and it is to be resumed early in the fiscal year. Up to the date of suspension 3,300 tons of riprap had been placed in the breakwater, extending it 168 feet and making its total length 4,740 feet. The contract expires December 31, 1893.

Proposals for hire of dredging plant to deepen the several bars in and at the mouth of the river were received, and a contract, dated May 26, 1893, was entered into with The W. H. Beard Dredging Company for furnishing and operating a suitable dredging plant at the rate of $18.50 per actual working hour. Work under this contract was begun June 21, 1893, and is still in progress. Up to July 1, 1893, the plant had worked fifty-one hours, dredging and removing 3,908 cubic yards of sand from the bar at the mouth of the river, making a depth of about 9 feet at mean low water in a cut 1,400 feet long and 25 feet wide.

After duly advertising and receiving proposals for construction of a dike on the west bank of the river at the "bend below Stratford," a contract was entered into under date of May 25, 1893, with D. V. Howell, for furnishing and placing about 2,000 tons of riprap at the rate of $1.27 per ton. The contractor has just begun shipping stone to the locality, and the actual construction work will be commenced early in July.

PRESENT CONDITION OF IMPROVEMENT.

The breakwater is now 4,740 feet long and contains about 36,937 tons of stone; for 3,250 feet nearest the shore end it is built to about half-tide level; the outer 1,490 feet are built up to 4 feet above mean high water, with top width of 5 feet.

During the past season the channels on the bars in the river have shoaled slightly. The available depth on the bar at the mouth is from 6 to 7 feet, and on the bars in the river generally from 4 to 5 feet at mean low water.

PROPOSED OPERATIONS.

Under existing contracts it is proposed to extend the breakwater about 250 feet further, to continue dredging at and near the mouth of the river, and to construct the shore end of the dike below Stratford.

Future appropriations should be applied to making and maintaining the river channel and to completing the breakwater and dike.

The estimated cost of completing this improvement is $112,000, to which should be added about $4,000 annually for maintenance of dredged channel and for repairs.

Appropriations for the Housatonic River have been made as follows:

Application.	Date.	Amount.
Examination	Mar. 2, 1867	$42
Survey	July 11, 1870	2,700
Sow and Pigs Jetty, dredging	Mar. 3, 1871	15,000
Drew Rock Jetty, dredging	June 10, 1872	15,000
Dredging	Mar. 3, 1873	10,000
Do	June 23, 1874	10,000
Do	Mar. 3, 1875	5,000
Do	June 18, 1878	5,000
Do	June 14, 1880	2,000
Do	Mar. 3, 1881	2,000
Removing Drew Rock and jetty in 1887	Aug. 2, 1882	2,000
Do	July 5, 1884	2,500
Do	Aug. 5, 1886	5,000
Commencing breakwater, dredging	Aug. 11, 1888	35,000
Extending breakwater, dredging	Sept. 19, 1890	35,000
Extending breakwater, dike, and dredging	July 13, 1892	20,000
Total		166,242

The Housatonic River is the boundary between the collection districts of New Haven and Fairfield. The nearest work of defense is Fort Hale, New Haven Harbor, about 15 miles east. The nearest light-house is on Stratford Point, at the mouth of the river.

Money statement.

July 1, 1892, balance unexpended		$11,044.68
Amount appropriated by act approved July 13, 1892		20,000.00
		31,044.68
June 30, 1893, amount expended during fiscal year		14,588.49
July 1, 1893, balance unexpended		16,456.19
July 1, 1893, outstanding liabilities	$1,648.76	
July 1, 1893, amount covered by uncompleted contracts	12,980.50	
		14,629.26
July 1, 1893, balance available		1,826.93
Amount (estimated) required for completion of existing project		112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for construction of breakwater at the mouth of the Housatonic River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1892.

No. of bid.	Name and address of bidder.	Rate per ton.	Amount of bid (7,500 tons).	Remarks.
1	John A. Bouker, New York City	$1.62	$12,150.00	
2	S. and E. S. Belden, Hartford, Conn	1.22	9,150.00	
3	Brown & Fleming, New York City	1.12	8,400.00	Lowest bid.

Abstract of proposals for hire of dredging plant for improving Housatonic River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, May 12, 1893.

No. of bid.	Name and address of bidders.	Price per hour.	Guaranteed rate of excavation per hour.	Remarks.
			Cu. yards.	
1	The W. H. Beard Dredging Co., New York City	$18.50	75	Equals 24⅔ cents per cubic yard. Lowest bid.
2	The Hartford Dredging Co., Hartford, Conn	22.00	70	Equals 31⅜ cents per cubic yard.

Abstract of proposals for construction of dike in Housatonic River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, May 12, 1893.

No. of bid.	Name and address of bidders.	Rate per gross ton of 2,240 pounds.	Amount of bid, 2,000 tons.	Remarks.
1	David V. Howell, New York City	$1.27	$2,540	Only bid received.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

At Shelton and Derby, head of navigation.

Vessels arriving and departing.	Number.	Tonnage.
Steamers	225	31,950
Sailing vessels	175	20,106
Barges	120	34,200
Total	520	86,256

Freight received and shipped.	Tons.	Estimated value.
Lumber, 2,750,000 feet	4,125	$68,750
Coal	60,000	300,000
Iron	10,000	140,000
Miscellaneous (including 8,500 tons of rubber)	35,575	1,519,288
Total	109,700	2,028,038

At Stratford, near mouth of river.

Vessels arriving and departing.	Number.	Tonnage.
Large vessels:		
Steamers	1,000	60,000
Sailing vessels	620	38,000
Barges in tow	75	22,500
Small vessels:		
Oystermen (sail vessels)	10,000	35,000
Total	11,695	155,500

Freight received and shipped.	Tons.	Estimated value.
Coal	40,000	$200,000
Oysters	125	12,500
Oyster shells	12,500	25,000
Miscellaneous	40,000	800,000
Total	92,625	1,037,500

The total tonnage of river freight as above reported is 202,325, being 6,155 tons less than that reported for 1891, but 63,525 greater than reported for 1890.

No new lines of transportation have been established upon this river since July 1, 1892.

D 10.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

This harbor extends nearly 3 miles inland from the north shore of Long Island Sound, its width of about 1 mile at the mouth decreasing to 200 feet between opposite wharves at its upper end. The channel, even in the widest part of the harbor, is comparatively narrow.

Before the first work by the United States was done at this harbor the depth over the bars at the harbor's mouth was about 5 feet at low water, equivalent to 11.5 at high water, and the low-water depth above the bridges was from 2 to 7 feet.

PROJECTS FOR IMPROVEMENT.

In 1833 a petition of the citizens of Bridgeport was presented to Congress asking an appropriation of $10,000 to improve the harbor. This was granted in 1836 and the agent in charge was instructed by the Engineer Department to dredge a channel 8 feet deep, making it 200 feet wide through the outer bar and 100 feet wide through the inner bar, or so much as the appropriation would admit of. The work was done by contract in 1837. The rate was high (understood to be 72.8 cents per cubic yard), and the funds were exhausted when the channel through the outer bar had been made 60 feet wide.

In 1838 Capt. Swift, U. S. Engineers, reported that the channel had been sounded, and was found to be 12 feet deep, or 4 feet deeper than when left by the dredger.

Nothing further was done until 1852, when a second appropriation of $10,000 was made.

Capt. Dutton, U. S. Engineers, found that the channel on the outer bar was then 6 feet deep and 90 feet wide, and on the inner but 5 feet deep, and he submitted a project for dredging through both bars to a depth of 8 feet and a width of 200 feet, at a total estimated cost of

$32,000. This project was approved by the Secretary of War February 5, 1853, and with the $10,000 then available channels 8 to 13 feet deep were dredged 100 feet through the inner bar, and 60 feet wide through the outer bar.

By act of Congress approved June 23, 1866, a survey of the harbor was ordered, which was made in that year. The object of the survey was to ascertain "the present state of the harbor, and the character and extent of the encroachments upon it by the action of the tides," it being feared that Long Beach, on the east side of the harbor's mouth, was making northwestward by reason of sand drifting along the shore in such a way as to contract and ultimately fill up the channel above the inner bar. Col. D. C. Houston, U. S. Engineers, then in charge, in his report on the survey, dated January 12, 1867, stated that it had been proposed to construct a breakwater, extending out from Long Beach to arrest the sand; but the danger feared did not seem imminent, and recommended a series of observations for the purpose of ascertaining the nature and amount of changes taking place.

In 1867 a survey of the shore line of Long Beach was made.

In 1868 the officer in charge was directed by the Chief of Engineers to make "such resurvey of Bridgeport Harbor, Connecticut, as may be found necessary to ascertain what changes have occurred since the survey of 1866." In the report on this survey it was stated that the channel remained the same, and that no appropriation was needed until "the channel is found inadequate to the necessities of commerce, and then dredging must be resorted to."

In 1870 a petition of citizens of Bridgeport was presented to Congress asking that an appropriation "be made to remove said sand bar (the outer bar) and to widen and deepen said channel and harbor in order that vessels drawing 12 feet of water may be enabled to enter without being grounded and without the aid of lighters," and a survey or examination of the harbor was ordered.

The work was then in charge of Gen. Warren, U. S. Engineers. He made an examination of the harbor and found it unnecessary to make further surveys. In his report, dated January 12, 1871, Gen. Warren submitted a project for dredging a channel 100 feet wide and 12 feet deep at extreme low water (or 14 feet deep at mean low water) and for building a pier 3,000 feet long, extending out from Long Beach, to be partly of riprap, partly of dolphins. The estimated cost of the project was $124,000. After an appropriation of $20,000 was made in 1871, work under this project was begun, dredging to depths of 12 and 13 feet at mean low water, and substituting a riprap jetty for riprap and dolphins. The jetty was completed, as far as deemed necessary, in 1873.

In 1875 the dimensions of the projected channel were modified so as to make it 12 feet deep at mean low water and from 200 to 300 feet wide. This was accomplished in 1882.

In 1878, in compliance with the terms of the appropriation act of that year, a channel 100 feet wide and 9 feet deep was dredged from the lower bridge to the horse railroad bridge, a distance of about 3,000 feet.

After the appropriation of 1882 a project for widening to 600 feet the channel between the Inner Beacon and the Naugatuck Railroad Wharf was adopted to prevent overcrowding the main channel by vessels entering to seek refuge during storms. The estimated cost was $60,000. This is nearly completed, a small area near the Inner Beacon remaining to be dredged.

In November, 1887, a petition was sent to the Secretary of War, signed by the mayor and other citizens of Bridgeport, asking that $10,000 be appropriated for a channel 8½ to 9 feet deep and 100 feet wide above the horse railroad bridge. This petition, with indorsements and reports estimating $18,000 as the cost of such work, is printed in the Annual Report of the Chief of Engineers for 1889, Part I, pp. 697–699.

The appropriation act of 1888 authorized this work, and the project was therefore extended to include it.

March 8, 1889, a petition was addressed to the Secretary of War by the mayor and other citizens of Bridgeport, representing the necessity of a breakwater within the harbor of Bridgeport. This petition, with indorsements, is printed in the Annual Report of the Chief of Engineers for 1889, Part I, pp. 700–702. The indorsements estimate the cost of a breakwater from the Tongue to the Inner Beacon at about $30,000, and authorize the extension of the project to include this work.

The project for improving this harbor, as thus extended, consists:

1. In dredging to make and maintain a channel 12 feet deep at mean low water, and 300 feet wide, or more, from Long Island Sound to the lower bridge, nearly completed. Estimated cost to complete, $17,000.

2. In dredging to make and maintain a channel 9 feet deep and 100 feet wide from the lower bridge to the head of the harbor, partly completed. Estimated cost to complete, $3,000.

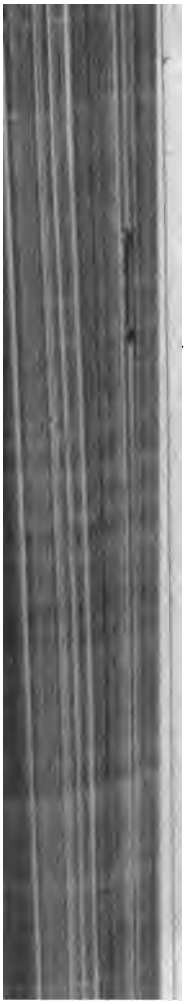
3. In building a breakwater from the Tongue to the Inner Beacon, partly finished. Estimated to cost $30,000, of which $15,000 have been appropriated.

It is probable that ultimately an extension of the east breakwater will be required.

Up to July 1, 1892, a breakwater had been built at Long Beach on the east side of the harbor entrance; the channel from Long Island Sound to the lower bridge had been dredged 12 feet deep and 300 feet wide, or over. Above the lower bridge, the channel had been made 9 feet deep at mean low water, with width of 100 feet to the horse-railroad bridge; thence for a distance of about 2,600 feet (to within 25 feet of the upper landing in the harbor), with width from 90 to 60 feet. The breakwater from the Tongue to the Inner Beacon had been built to its full length, 1,165 feet, with top width of 5 feet at 3 feet above high water, a cross section adopted in order to cover the whole distance at once and thus prevent scouring on line of work.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Under act of Congress approved July 13, 1892, $20,000 were appropriated with proviso that the money was to be applied to dredging between the Inner Beacon and the Naugatuck Wharf. After duly advertising, proposals for dredging were received and a contract with Alonzo J. Beardsley, for dredging about 190,000 cubic yards of material, at the rate of 9½ cents per yard, was entered into October 10, 1892. Dredging under this contract was begun November 11, 1892, and completed May 2, 1893, 190,132 cubic yards of mud being removed. The channel between the Inner Beacon and the Naugatuck Wharf was widened 170 feet for practically the whole length (about 2,690 feet) making the width at that part of the harbor about 770 feet, and adding 11 acres to the available anchorage in the harbor; the depth made was 12 feet at mean low water.



repairs are now needed.

The project of 1882 for making 600 feet width of channel inner beacon and the Naugatuck Railroad Wharf was re pleted in 1887. A greater width (770) feet was obtained i inner beacon has since been rebuilt, and its location sligh which makes it desirable to cut off a short point outside t tion of that beacon. This was partly done in 1888.

The breakwater from the Tongue to the Inner Beacon ha to full length, but not to the cross section necessary for pe

PROPOSED OPERATIONS.

With future appropriations it is proposed to complete above the bridges, to remove the shoal places above the Railroad Wharf, and to widen the channel eastward to th an additional width of about 200 feet; also to complete the from the Tongue to the Inner Beacon. The estimated cost work is, as heretofore reported, $35,000; the appropriatio made in 1892, was applied in compliance with the terms o priation act to work not included in the general project fo the harbor, therefore the cost of completion is not reduced.

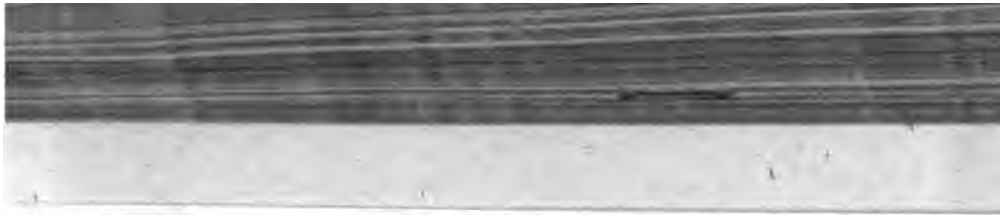
The project could be completed to advantage in a single mated cost.

The annual cost of maintaining the dredged channels in is estimated at $3,000.

Appropriations for the improvement of Bridgeport Harb made as follows:

Application.	Da
Dredging outer bar	July
Dredging outer and inner bars	Aug. 3
Survey	June 2
Do	July 1
Dredging and 521 feet of breakwater	Mar.
Dredging and 859 feet of breakwater	June 1
Dredging inner bar and upper harbor	Mar.
Dredging bridge to Long Island Sound (9 feet)	June 2
Dredging bridge to Long Island Sound (12 feet)	Mar.
Dredging upper harbor (9 feet)	Aug. 1
Dredging above bridge and outer bar (9 and 12 feet)	June 1
Dredging bridge to Long Island Sound (12 feet)	Mar.
Do	June 1
Dredging above inner beacon (12 feet)	Mar.
Dredging between inner beacon and railroad wharf (12 feet)	Aug.
Do	July
Do	Aug.





Bridgeport, the port of entry for the collection district of Fairfield, is situated about 2 miles from Long Island Sound, at the head of Bridgeport Harbor.

There is a light-house at the entrance to the harbor.

Fort Hale, New Haven Harbor, the nearest work of defense, is 18 miles east.

Money statement.

July 1, 1892, balance unexpended	$1,410.15
Amount appropriated by act approved July 13, 1892	20,000.00
	21,410.15
June 30, 1893, amount expended during fiscal year	20,221.78
July 1, 1893, balance unexpended	1,188.37
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	35,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in the harbor of Bridgeport, Conn., opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 27, 1892.

No. of bid.	Name and address of bidder.	Rate per cubic yard, scow measurment.	Amount of bid (200,000 cubic yards).
		Cents.	
*1	Alonzo J. Beardsley, Bridgeport, Conn	9½	$19,000
2	Charles and H. E. DuBois, New York City	10	20,000

* Entered into contract October 10, 1892; contract completed May 2, 1893; 190,132 cubic yards dredged.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Arrivals and departures of vessels.

[Draft, 6 to 18 feet.]

	No.	Tonnage.
Foreign arrivals	28	4,448
Foreign departures	15	2,425
Coastwise arrivals and departures	24,180	1,837,426
Total	24,223	1,844,299

Cargoes.

	Tons.	Estimated value.
Receipts	915,350	$42,670,000
Shipments	408,840	41,629,000
Total	1,324,190	84,299,000

During 1892, 4,520 vessels, carrying 369,350 tons cargo, entered the harbor for refuge.

The above report shows a reduction of freight of 11,684 below that reported for 1891.

No new lines of transportation have been established since July 1, 1892.

The severe gale on the 20th of April, 1892, destroyed considerable of the oyster industry, which to some extent diminished the number of vessels arriving and departing.

D 11.

IMPROVEMENT OF BLACK ROCK HARBOR.

This harbor, 1½ miles long from northeast to southwest, and from 300 to 2,500 feet wide, lies between the mainland on the west and Fayerweather Island on the east, and includes the navigable part of Cedar Creek, a small tidal inlet which extends up into the western part of the city of Bridgeport, and affords water communication of great value to several large manufactories in its immediate neighborhood. It is in the interest of the city of Bridgeport that the improvement of Black Rock Harbor is desired.

The depth in the lower part of the harbor is from 6 to 12 feet at mean low water. This part of the harbor was formerly much used as a refuge for vessels overtaken by storms, but it is not deep enough for most vessels now engaged in commerce through the sound. Before work was done in Cedar Creek the depth there was from from 2 to 4 feet, and the channel was narrow and crooked.

The head of the harbor was separated from Long Island Sound on the southeast by a broad, flat sand bar, which was bare at about half-tide, and which joined Fayerweather Island with the main shore.

PROJECTS FOR IMPROVEMENT.

Between 1836 and 1838 $21,500 were expended in building a sea wall across a breach in the southern part of Fayerweather Island to preserve the light-house reservation at the south end of the island and to prevent shoaling on the anchorage ground.

In 1882 a survey of the harbor was ordered by Congress, which was made in 1883. In his report on this survey, dated December 12, 1883, Col. McFarland, U. S. Engineers, submitted a project providing—

1. For protecting the upper part of the harbor from the sea by building a breakwater over the bar northeast of Fayerweather Island, to be about half a mile long and 6 feet wide at the top, which was to be 3½ feet above mean high water or 10 feet above low water.

2. For making a channel 80 feet wide and 6 feet deep at mean low water, extending up Cedar Creek.

The estimated cost was:

Breakwater	$58,000
Dredging	22,000
Total	80,000

Work under this project was begun in 1885, and up to July 1, 1892, the breakwater had been built to its full length, in order to prevent the currents from cutting a channel across the bar, but its cross section

was less than designed, both in height and width; also a channel 6 feet deep, or over had been dredged, with width of 80 feet, extending from deep water northward up Cedar Creek to within 500 feet of the head of the creek, being 2,200 feet north of the Forge Company's wharf. This channel was further widened and deepened in places by private parties.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act of July 13, 1892, appropriated $5,000 for continuing this improvement. Proposals for dredging were received and a contract with Alonzo J. Beardsley, for dredging about 25,000 cubic yards at the rate of 17 cents per yard was entered into under date of October 10, 1892, and approved by the Chief of Engineers October 18, 1892.

Work under this contract has not yet been begun. The contract expires December 31, 1893.

PRESENT CONDITION OF IMPROVEMENT.

The sea wall built in 1836–1838 across a breach in Fayerweather Island is still effective in preserving the island and preventing the sea from washing over into the harbor. It needs some repair.

The breakwater between Fayerweather Island and the mainland is built to its full length, 2,744 feet, with diminished cross section.

The 6-foot channel has been dredged to the head of navigation in Cedar Creek, the east branch of the harbor, with full projected width and depth, and is now in good condition.

Additional dredging to widen and deepen the channel in places has been done by private parties.

PROPOSED OPERATIONS.

Under the contract now in force it is proposed to remove shoals from and to widen at its lower end the channel previously dredged.

Future appropriations will be needed from time to time to maintain the dredged channel and to enlarge or repair the breakwater.

Appropriations for the improvement of Black Rock Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Building sea wall on Fayerweather Island	1836–1838	$21,500
Survey	Aug. 2, 1882	350
Building breakwater and dredging	July 5, 1884	20,000
Dredging	Aug. 5, 1886	5,000
Do	Aug. 11, 1888	10,000
Do	Sept. 19, 1890	5,000
Do	July 13, 1892	5,000
Total		66,850

Black Rock Harbor is in the Fairfield collection district, of which Bridgeport is the port of entry. There is a light-house at the harbor entrance. Fort Hale, New Haven Harbor, the nearest work of defense, is 20 miles east.

Money statement.

July 1, 1892, balance unexpended	$405.63
Amount appropriated by act approved July 13, 1892	5,000.00
	5,405,63
June 30, 1893, amount expended during fiscal year	435.97
July 1, 1893, balance unexpended	4,969.66
July 1, 1893, amount covered by uncompleted contracts	4,250.00
July 1, 1893, balance available	719.66
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	10,000.00

Abstract of proposals for dredging in the harbor of Black Rock, Conn., opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 27, 1892.

No. of proposals.	Name and address of bidder.	Rate per cubic yard, scow measment.	Amount of bid (40,000 cubic yards).
		Cents.	
*1	Alonzo J. Beardsley, Bridgeport, Conn	17	$6,800
2	Charles and H. E. DuBois, New York City	17	6,800

*Entered into contract October 10, 1892, for about 25,000 cubic yards; work not yet begun; contract expires December 31, 1893.

COMMERCIAL STATISTICS FOR THE CALENDER YEAR 1892.

Freight received and shipped by water.

Articles.	Tons.	Estimated value.
Coal	45,602	$182,408
Iron and steel	1,200	21,600
Miscellaneous	5,651	173,595
Total	52,453	377,603

Vessels used in above traffic.

[Draft, 6 to 12 feet; tonnage, 50 to 456 tons.]

Steamers	141
Sailing vessels	80
Barges	261
Total	482

In addition to the above 2,100 vessels entered Black Rock Harbor for refuge during 1892.

The above figures show a decrease in tonnage of freight below that reported for 1891 of 6,530 tons.

No new lines of transportation have been established since July 1, 1892.



THE GEORGE
HOTEL

To accompany Annual Re
for 1892.

Henry M. Robert
Lieut. Col., Corps of E

D 12.

IMPROVEMENT OF SAUGATUCK RIVER, CONNECTICUT.

The navigable part of this river covers a distance of about 4½ miles by course of channel from Westport to Long Island Sound; near its mouth the inlet expands into a rather broad bay, the channel following the west and south sides in a very circuitous course before reaching the open Sound. About 1¼ miles below Westport the river is crossed by a wagon bridge, and a quarter of a mile further down at Saugatuck village by the bridge of the New York, New Haven, and Hartford Railroad, both having draws of sufficient width.

The available depth to Saugatuck is about 5 feet at mean low water in a channel for the most part narrow and crooked; above Saugatuck the depth gradually diminishes to practically nothing at Westport. Part of the way there are dangerous rocks in or close to the channel. Outside the mouth of the harbor lies Cockenoes Island with a reef of bowlders extending out 1½ miles to the east. The only entrance to the harbor at low tide is east of this reef, for the island is connected with Great Marsh (part of the right bank) by a broad shoal nearly bare at low tide. To save the distance around the reef, a canal was cut through Great Marsh in 1836–'40, but for about forty years it has not been in condition for use.

The mean rise of tide is about 7 feet.

PROJECTS FOR IMPROVEMENT.

Improvements at this locality have heretofore been made by the United States for Saugatuck or Westport Harbor, Connecticut, as follows:

In 1827–1836, certain obstructions in the river were removed; the amount of this work is not known, but is supposed to have been very small.

In 1826–1829 and in 1837–'38, a breakwater or sea wall was built on Cedar Point, at the east side of the river's mouth, to secure the beach which was in danger of washing away and into the channel; the breakwater was built about 390 feet long, 10 feet wide on top, and to a height of 4 feet above high water. In 1870 the seas had cut partly through the beach at the north or shore end of the wall and had undermined part of the wall; 64¼ feet of the old wall were rebuilt and it was extended northward 43¾ feet, making its present length about 434 feet; the new work was 5½ feet wide on top and from 1 to 2 feet higher than the old wall.

In 1836–'40 a canal was cut through Great Marsh, extending from a bend in the river near its mouth into the bay outside, with the object of "facilitating commercial intercourse between the port of Saugatuck (now Westport) and the city of New York," by cutting off the natural channel around Cockenoes Island, saving a distance of from 4 to 5 miles between the points named. The canal was made 68 feet wide at high water, 44 feet wide at the bottom, and was 1,350 feet long. The material removed was piled up on the banks. Part of the east side was protected by a dry wall of small stones extending out into the bay and terminating in a beacon.

The present condition of the breakwater on Cedar Point is fair. The canal was used more or less for ten years, but gradually filled up, and for forty years past has been of little use, except for the smallest ves-

sels light loaded. At either end it is nearly bare at low water, with an average depth of 1 to 2 feet inside.

In 1883 an examination of this harbor was made in pursuance of the river and harbor act of August 2, 1882. The officer in charge recommended that the canal be abandoned, and that a survey be made to determine the cost of excavating a channel 4 feet deep up to the village of Westport, as being an improvement worthy to be made, provided it could be done at reasonable cost. A survey was made in accordance therewith, and an estimate of $36,000 submitted for such a channel, to be 100 feet wide, including removal of a few bowlders in and near the channel. (See Annual Report of the Chief of Engineers for 1884, Part II, p. 675.)

In 1886 certain citizens of Westport addressed a petition to the Secretary of War urging the reopening of the canal through Great Marsh.

The river and harbor act of 1890 directed a preliminary examination of Saugatuck River, which was made and reported upon under date of January 8, 1891. (Report printed in House Ex. Doc. No. 179, Fifty-first Congress, second session, and in the Annual Report of the Chief of Engineers for 1891, Part I, p. 840.)

In the report estimates were presented—

1. For a channel 100 feet wide and 6 feet deep at mean low water up to the village of Westport	$40,000
2. For a channel 100 feet wide and 4 feet deep at mean low water to Westport	10,000
3. For reopening the canal, making it 100 feet wide and 5 feet deep at mean low water	21,000

with recommendations that the improvement of the natural channel should precede any work on the canal.

By act of Congress approved July 13, 1892, $7,000 were appropriated for improving Saugatuck River "to be expended in the improvement of the natural channel," and by approval of the Secretary of War July 21, 1892, the project was adopted providing for a depth of 4 feet and width of 100 feet to the village of Westport, at an estimated cost of $10,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Under the appropriation, as above, proposals for dredging were received, and under date of February 25, 1893, a contract was entered into with E. R. Seward, of Albany, N. Y., to do the required work at the rate of 27 cents per cubic yard. Dredging under this contract was begun May 8, 1893, and up to the close of the fiscal year 3,651 cubic yards of mud, sand, and stones had been dredged, making a channel 60 feet wide and 4 feet deep at mean low water, extending from the 4-foot curve about 900 feet northward towards the Westport wharves. Work is still in progress. The contract expires October 31, 1893.

PRESENT CONDITION OF IMPROVEMENT.

The condition of dredged channel is as above described.

PROPOSED OPERATIONS.

Under the existing contract it is proposed to extend the 4-foot channel as far as the available funds will permit.

Future appropriations will be applied to dredging to complete the project.

Appropriations for the improvement of Saugatuck River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging	July 13, 1892	$7,000.00

Saugatuck River is in the Fairfield collection district, of which Bridgeport is the port of entry.

The nearest light-house is on Sheffield Island, 5 miles southwest from the river's mouth.

Fort Hale, New Haven Harbor, about 27 miles east, is the nearest work of defense.

Money statement.

Amount appropriated by act approved July 13, 1892		$7,000.00
June 30, 1893, amount expended during fiscal year		970.93
July 1, 1893, balance unexpended		6,029.07
July 1, 1893, outstanding liabilities	$765.25	
July 1, 1893, amount covered by uncompleted contracts	4,954.23	
		5,719.48
July 1, 1893, balance available		309.59
Amount (estimated) required for completion of existing project		3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in Saugatuck River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, February 2, 1893.

No. of bid.	Name and address of bidder.	Rate per cubic yard, scow measurement.	Amount of bid (20,000 cubic yards).	Remarks.
		Cents.		
1	Alonzo J. Beardsley and George B. Beardsley, Bridgeport, Conn.	28	$5,600	
2	Alonzo E. Smith, Islip, N. Y.	31	6,200	
*3	E. R. Seward Albany, N. Y	27	5,400	Lowest bid.
4	The Hartford Dredging Company, Hartford, Conn	29	5,800	

* Entered into contract February 25, 1893; in progress; contract expires October 31, 1893.

COMMERCIAL STATISTICS.

These statistics have been asked for but have not as yet been received.

D 13.

IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

Norwalk Harbor or River is a tidal estuary, with a narrow channel extending about 3 miles north from Long Island Sound to the town of Norwalk. Above Norwalk the river is a small fresh-water stream. South Norwalk is on the west bank of the river, 1½ miles below Norwalk. At this point the river is crossed by two drawbridges, the lower one a highway bridge, and the other (450 feet above) the bridge of the New York, New Haven and Hartford Railroad.

In 1867 a company was incorporated under the laws of the State of Connecticut for the improvement of the river. Little work was done, and when improvement was begun by the United States the low-water depth to South Norwalk was 5 feet, and to Norwalk but 1 foot.

PROJECT FOR IMPROVEMENT.

By act of March 2, 1829, Congress appropriated $80 "for making a survey of the harbor of Norwalk, Conn., with a view to its improvement." The survey was made by Capt. Hartman Bache, U. S. Engineers, who, in his report on the same, dated May 10, 1830, recommended excavating the channel, proposing to build a steam dredge for the purpose.

The cost was estimated as follows:

For a channel 12 feet deep at ordinary high water	$15,668.95
For a channel 10 feet deep at ordinary high water	12,286.45

No money was appropriated for carrying out this plan, and in 1871 another survey was ordered by Congress which was made in the same year.

In his report on the latter survey, dated December 16, 1871 (printed in Senate Ex. Doc., No. 23, Forty-second Congress, second session; also in the Annual Report of the Chief of Engineers for 1872, p. 900), Gen. Warren, U. S. Engineers, submitted a project for dredging a channel 6 feet deep and 100 feet wide from Long Island Sound up to Norwalk, at an estimated cost of $34,000.

In 1880 the terms of the river and harbor act provided that "so much of said appropriation ($5,000) as shall be necessary therefor shall be so expended as to have a channel 6 feet deep at low water between the steamboat landing in said Norwalk and Long Island Sound." As a channel of the projected width (100 feet) and depth of 6 feet at mean low water existed, this was interpreted as requiring a depth of 6 feet at extreme low water (see Annual Report of the Chief of Engineers for 1881, Part I, p. 609), which would be of 8 feet at mean low water, and the project was accordingly modified to provide for obtaining that depth up to South Norwalk, where the steamboat landing was.

The latest estimate, made to include the cost of this modification and of a large amount of dredging already required to maintain the channel, places the total cost from the time of beginning work at $84,000.

Up to July 1, 1892, the channel below South Norwalk had been dredged 100 feet wide and 8 feet deep at mean low water, and above South Norwalk it had been made from 60 to 100 feet wide and 6 feet deep, and the project was considered practically completed.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

The channel below South Norwalk is 100 feet wide and 8 feet deep at mean low water; from South Norwalk to Norwalk it is from 60 to 100 feet wide and 6 feet deep, except some slight shoaling which has occurred in the upper part of the harbor.

PROPOSED OPERATIONS.

The project is considered practically completed, and no further work under it is required, except such dredging as may be necessary from time to time to maintain the depths already made. No appropriation is needed for the ensuing year.

Appropriations for improving Norwalk Harbor have been made as follows:

Application.	Date.	Amount.
Survey	Mar. 2, 1829	$80.00
Do	Mar. 3, 1871	1,166.66
Dredging (6 feet) above South Norwalk	June 10, 1872	10,000.00
Do	Mar. 3, 1873	10,000.00
Do	June 23, 1874	10,000.00
Dredging (6 feet) below South Norwalk	Mar. 3, 1875	7,000.00
Do	June 18, 1878	6,000.00
Dredging (6 feet) above and below South Norwalk	Mar. 3, 1879	10,000.00
Dredging (6 feet) below South Norwalk	June 14, 1880	5,000.00
Dredging (8 feet) below and (6 feet) above South Norwalk	Mar. 3, 1881	5,000.00
Dredging (6 feet) above South Norwalk	Aug. 2, 1882	5,000.00
Dredging (8 feet) below South Norwalk	July 5, 1884	5,000.00
Dredging (6 feet) above South Norwalk	Aug. 5, 1886	3,000.00
Dredging (6 feet) above and (8 feet) below South Norwalk	Aug. 11, 1888	*3,000.00
Do	Sept. 19, 1890	4,000.00
Total		84,246.66

*Part of an appropriation of $28,000, of which $25,000 was required to be expended at Wilsons Point

Norwalk is in the Fairfield collection district, and is 11 miles west of Bridgeport, the port of entry.

Norwalk light-house is on Sheffield Island, at the harbor entrance.

The nearest work of defense is Fort Schuyler, Throgs Neck, at the head of Long Island Sound, about 29 miles southwest.

Money statement.

July 1, 1892, balance unexpended	$183.53
June 30, 1893, amount expended during fiscal year	183.53

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

These are not yet received, but the commerce would vary probably but little from that of 1891, which was reported as follows:

Commercial statistics for the calendar year 1891.

ARRIVALS AND DEPARTURES OF VESSELS.

[Draft, 7 to 12 feet; tonnage, 100 to 500 tons.]

Kind of vessels.	No. of round trips.
Steamers	1,051
Sail vessels	475
Barges and canal boats	600
Total	2,126

CARGOES.

Articles.	Tons.	Estimated value.
Coal	100,000	$400,000
Lumber (16,000,000 feet)	18,500	360,000
General merchandise	250,000	15,000,000
Total	368,500	15,760,000

D 14.

IMPROVEMENT OF HARBOR AT WILSONS POINT, CONNECTICUT.

Wilsons Point Harbor is a bay on the north shore of Long Island Sound, about 1½ miles west from the mouth of Norwalk River or Harbor.

The lower half of the harbor is about half a mile wide, with depth decreasing from 16 feet gradually to 6 feet at Wilsons Point; the upper half is from 1,000 to 500 feet wide, with depth of 3 feet or less at low tide. The harbor is sheltered by the mainland and by Sheffield Island (the most westerly of the Norwalk Islands) from all quarters, except the southwest; it is partly sheltered from the southwest by Bell Island, an island separated from the mainland by a marsh and narrow creek.

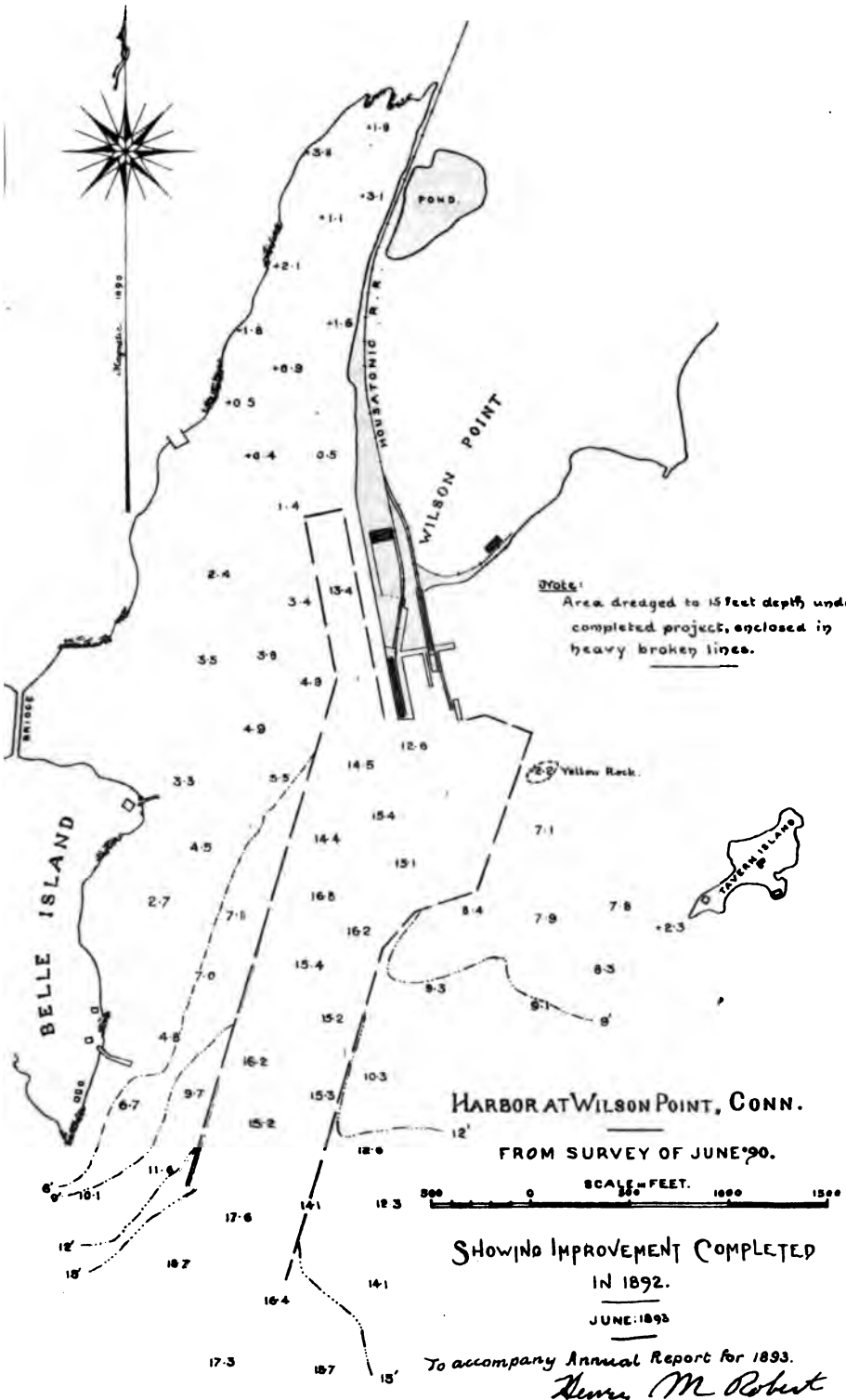
Wilsons Point Harbor has been used to some extent for many years as a harbor of refuge and place to lie up for the night by fishing boats and oyster steamers, and occasionally by barges caught out in storms.

There is no settlement upon the shores of the harbor, except a collection of summer cottages on Bell Island.

A few years ago the Danbury and Norwalk Railroad Company (now a branch of the Housatonic Railroad Company) made Wilsons Point their terminus, and subsequently the New England Terminal Company was formed to construct docks, car yards, and coal sheds, and to operate in the interest of the Housatonic Railroad and its connections. A large dock was built, with transfer bridges, by which freight cars were taken on board steamers, and freight carried to New York City without unloading and reloading.

PROJECTS FOR IMPROVEMENT.

March 3, 1888, a letter was sent by the Hon. William P. Frye, United States Senator, to the Secretary of War, asking that a special examination of Norwalk Harbor be made with reference to developing busi-


Magnetic 1893
POND
HOUSATONIC R.R.
WILSON POINT
BRIDGE
Yellow Rock
BELLE ISLAND
TAVERN ISLAND
Note:
Area dredged to 15 feet depth under completed project, enclosed in heavy broken lines.
HARBOR AT WILSON POINT, CONN.
FROM SURVEY OF JUNE 1890.
SCALE IN FEET.
500 0 500 1000 1500
SHOWING IMPROVEMENT COMPLETED IN 1892.
JUNE: 1893
To accompany Annual Report for 1893.
Henry M Robert
Lieut. Col. Corps of Engineers.

Eng 93

ness which urgently required further improvements. This letter was referred to Col. Houston, U. S. Engineers, for report. Upon inquiry it was learned that the business referred to was that of the railroad terminus at Wilsons Point, and that it was desired that the United States undertake dredging a channel 15 feet deep and 300 feet wide up the harbor to the vicinity of the railroad wharves. There was no money available for a detailed examination of the locality, but estimates for dredging, based upon recent U. S. Coast Survey charts, were made as follows:

230,000 cubic yards at 20 cents	$46,000
Contingencies, 15 per cent	6,900
Total	52,900

The river and harbor act of 1888 made appropriation for Norwalk Harbor, Connecticut, of $28,000, with provision as follows:

Twenty-five thousand dollars of which shall be expended in dredging and deepening the channel in the lower harbor, up to Wilson Point.

Up to July 1, 1892, the channel close to the docks had been dredged by the Terminal Company to 12 feet depth at mean low water; outside this the channel had been made 15 feet deep at mean low water to Long Island Sound, and 700 feet wide with an additional width of 200 feet on the east side for a distance of 750 feet south from the wharves; the 15-foot channel had also been extended northward parallel to the wharves and 75 feet westward from them, with 200 feet width.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

The channels, as above described, remain in good condition.

PROPOSED OPERATIONS.

The improvement of this harbor is completed as far as now designed; no further work is projected and no appropriation is required.

Appropriations for improving harbor at Wilsons Point have been made as follows:

Application.	Date.	Amount.
Dredging*	Aug. 11, 1888	$25,000
Do	Sept. 19, 1890	30,000
Total		55,000

*Part of an appropriation of $28,000 for Norwalk Harbor, directed by the appropriation act to be expended at Wilsons Point.

Wilsons Point is in the Fairfield collection district, and is about 14 miles southwest from Bridgeport, the port of entry.

Norwalk light-house, on Sheffield Island, is about half a mile south of the harbor.

The nearest work of defense is Fort Schuyler, Throgs Neck, at the head of Long Island Sound, about 29 miles southwest.

Money statement.

July 1, 1892, balance unexpended	$8,333.70
June 30, 1893, amount expended during fiscal year	7,010.60
July 1, 1893, balance unexpended	1,323.10

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

No statistics of the commerce of this harbor have been received since 1890, when 221,202 tons were reported.

The conditions have changed since then and the tonnage for 1892 was presumably very much less.

D 15.

IMPROVEMENT OF FIVE MILE RIVER HARBOR, CONNECTICUT.

This harbor is an inlet on the north shore of Long Island Sound, about 2 miles west of the mouth of Norwalk Harbor, Connecticut. It is about 1 mile long and from 300 to 800 feet wide. About three-quarters of a mile above its mouth it runs bare at low tide. At the mouth the depth is about 3 feet, increasing to 9 feet at a point about 750 feet out into the Sound. The mean rise of tide is about 7 feet.

Since 1848 Five Mile River has been largely engaged in oyster-growing, and in this business now employs about 140 vessels.

These vessels could only enter or leave the harbor at high tide; consequently during their busy season they were obliged to lie up for the night at other and less convenient harbors.

PROJECT FOR IMPROVEMENT.

By act of Congress approved August 5, 1886, a survey or examination of this harbor was ordered, which was made in the following fall, and reported on under date of December 7, 1886 (report printed in the Annual Report of the Chief of Engineers for 1887, Part I, p. 639).

In this report a project for improvement was proposed, which consisted in dredging a channel 8 feet deep at mean low water and 100 feet wide, to extend up the harbor, and to be about 6,000 feet long; the estimated cost was $25,000. This project was adopted in 1888, when work under it was ordered by the appropriation of $5,000 made by act of Congress of August 11, 1888.

Up to July 1, 1892, 52,938 cubic yards had been dredged under this project, making the channel about 2,450 feet long, 60 feet wide, and 8 feet deep at mean low water.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Five thousand dollars was appropriated for continuing this improvement by act of Congress approved July 13, 1892; proposals were received and a contract for dredging about 30,000 cubic yards at the rate of 14½ cents per yard was entered into with Alonzo J. Beardsley, dated October 10, 1892. Work has not yet been begun; the contract expires July 31, 1893.

PRESENT CONDITION OF IMPROVEMENT.

Under the existing project the channel has been dredged from deep water in Long Island Sound about 2,450 feet up the harbor, with width of 60 feet and depth of 8 feet at mean low water. It retains its depth fairly well, the only shoaling being from a slight falling in of its banks.

PROPOSED OPERATIONS.

Under the contract now in force it is proposed to extend the channel about 1,000 feet farther up the harbor, and with future appropriations to extend and widen it as provided for in the project for improvement.

Appropriations for improving harbor at Five Mile River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging	Aug. 11, 1888	$5,000
Do	Sept. 19, 1890	5,000
Dredging (not yet expended)	July 13, 1892	5,000
Total		15,000

Five Mile River is in the Fairfield collection district, and is about 13 miles west of Bridgeport, the port of entry.

The nearest light-house is on Sheffield Island, nearly 2 miles from the mouth of the harbor.

The nearest work of defense is Fort Schuyler, at the head of Long Island Sound, 27 miles southwest.

Money statement.

July 1, 1892, balance unexpended	$113.04
Amount appropriated by act approved July 13, 1892	5,000.00
	5,113.04
June 30, 1893, amount expended during fiscal year	84.46
July 1, 1893, balance unexpended	5,028.58
July 1, 1893, amount covered by uncompleted contracts	4,350.00
July 1, 1893, balance available	678.58
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in the harbor of Five Mile River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1892.

No. of bid.	Name and address of bidder.	Rate per cubic yard—scow measurement.	Amount of bid, 20,000 cubic yards.	Remarks.
		Cents.		
1	Hartford Dredging Co., Hartford, Conn	16 9/10	$3,380	
2	Charles and H. E. Dubois, New York City	15	3,000	
*3	Alonzo J. Beardsley, Stratford, Conn	14½	2,900	Lowest bid.

*Entered into contract October 10, 1892, for about 30,000 cubic yards; work not yet begun; contract expires July 31, 1893.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1892.

[From information furnished by Mr. Chas. W. Bell, of Five Mile River, Conn.]

Oysters raised	bushels..	720,000
Value of oysters raised		$432,000
Steamers employed		26
Sail vessels employed		112
Draft of above vessels	feet..	1½ to 8
Tonnage of above vessels	tons..	2 to 100
Value of above vessels, about		$225,000
Coal received by water	tons..	11,000

One thousand four hundred barrels of oysters were packed here for export to Great Britain; 28,000 barrels were packed at Norwalk and other places for export by planters that belong here, for we still lack water and wharfage to accommodate the business that would be done here. Round clams shipped from here, 800 barrels. Five cargoes of bricks brought here. Two hundred and fifty thousand bushels of oysters delivered on board of vessels here. One hundred vessels came in this harbor for refuge in the past year.

No new lines of transportation have been established since July 1, 1891.

D 16.

IMPROVEMENT OF STAMFORD HARBOR, CONNECTICUT.

This is a small harbor on the north shore of Long Island Sound, about 6 miles east of the New York State line. The harbor consists of a bay about a mile long and a mile broad, at the head of which two channels extend up nearly a mile toward the middle of the village. The west branch is the mouth of Mill River, a small stream dammed at Oliver Street Bridge, the head of the harbor; the original low-water depth for a mile below the bridge was from 1 to 3 feet in a crooked channel, and the 7-foot curve in the bay was about 7,500 feet below the bridge; all the wharves are in the upper half of this distance. The east branch was originally a crooked stream running through Salt Marsh; it was straightened and deepened by private enterprise and was known as "the canal." Though nominally under control of the corporation which deepened it, the east branch has been for a long time practically, and recently has been formally, opened to free public use. In 1892 it had an available depth of 6½ feet at mean low water, with width of about 60 feet nearly to its head.

The mean rise of tide in Stamford Harbor is about 7.9 feet.

PROJECTS FOR IMPROVEMENT.

By act of March 2, 1829, Congress appropriated $100 for making a survey of the harbor of Stamford, Conn., with a view to its improvement. The survey was made by Capt. Hartmann Bache, U. S. Engineers, in 1829. In his report on the same, dated May 10, 1830, Capt. Bache recommended excavating the channel (proposing to build a steam dredge for the purpose), the cost being estimated as follows:

For a channel 12 feet deep at ordinary high water (about 4 feet at mean low water)	$13,250.00
For a channel 10 feet deep at ordinary high water	11,035.20

No money was appropriated for carrying out this plan.

The river and harbor act of 1882 authorized a survey of this harbor, which was made in the following year. In his report on this survey, dated December 12, 1883 (printed in Senate Ex. Doc. No. 50, Forty-eighth Congress, first session; also, in Annual Report of the Chief

of Engineers for 1884, Part I, p. 672), Col. McFarland, U. S. Engineers, submitted a project for dredging a channel 80 feet wide and 5 feet deep at mean low water, from deep water in the bay up to Oliver Street Bridge, estimated to cost as follows:

Dredging, 80,000 cubic yards of mud, at 20 cents	$16,000.00
Contingencies	4,000.00
Total	20,000.00

It was not intended to include the removal of the ledge under and just below the bridge.

The beginning of the work under this project was approved by the Secretary of War August 30, 1886, after the first appropriation for improving the harbor had been made.

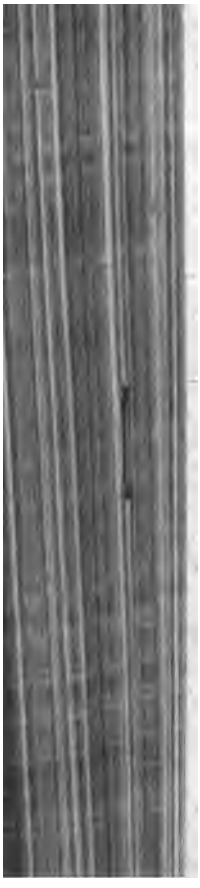
Up to July 1, 1892, the channel of the west branch had been made 5 feet deep at mean low water and about 80 feet wide up to within 1,000 feet of the head of the harbor. Near the head of the harbor the width was from 50 to 70 feet; at the bends of the channel the width had been made from 100 to 140 feet. No work had been done in the east branch. The project of 1883 was considered practically completed.

Under the river and harbor act approved September 19, 1890, a survey of Stamford Harbor was made, the report on which, dated September 16, 1891, was printed in the Annual Report of the Chief of Engineers for 1891, Part I, p. 849, *et seq.* This report presents a project for enlarging the channel of the west branch of the harbor to accommodate the growing commerce of Stamford, and estimates were submitted, as follows:

Dredging to make the channel 150 feet wide and 7 feet deep at mean low water: 190,000 cubic yards, at 21 cents	$39,900.00	
Contingencies and supervision, about	6,100.00	
		$46,000.00
Dredging to make the basin between harbor lines at the head of the harbor 7 feet deep: 150,000 cubic yards, at 28 cents	42,000.00	
Contingencies and supervision, about	7,000.00	
		49,000.00
Total estimated cost		95,000.00

The river and harbor act of July 13, 1892, appropriated $15,000 for improving harbor at Stamford, Conn., with proviso that not less than one-half the sum should be expended on the east branch. This appropriation was evidently based upon the survey of 1890-'91, which was before Congress at the time, and also upon a desired improvement of the east branch, which had not been asked for at the time when the survey was made. Therefore the east branch was surveyed and a project submitted for making the channel 9 feet deep at mean low water, to be 100 feet wide for a length of 8,535 feet and 50 feet wide for about 1,200 feet to the head of navigation, by dredging and removing rocks and bowlders, at an estimated cost of $28,500. The plans for improvement of both branches were adopted, and the project of 1892 now consists of:

Dredging to make the channel in the West Branch 150 feet wide and 7 feet deep at mean low water, 190,000 cubic yards, at 21 cents	$39,900
Dredging to make the basin between harbor lines at the head of the West Branch 7 feet deep at mean low water, 150,000 cubic yards, at 28 cents	42,000
Dredging to make the channel in the East Branch 9 feet deep at mean low water, 100 feet wide to the Steamboat Wharf, a distance of about 8,535 feet, and 50 feet wide for 1,200 feet further, 160,000 cubic yards, at 16 cents	25,600
Contingencies, inspection, etc., estimated at	16,000
Total estimated cost of project of 1892, from beginning	123,500



Proposals for dredging were advertised for, and recei
date of February 25, 1893, a contract was entered into
Seward, of Albany, N. Y., for dredging at the rate o
cubic yard. The contract expressly provided that worl
April 1, 1893. The contractor had no plant of his own
at that time, and was unable to promise to begin be
therefore, by authority of the Chief of Engineers, date
contractor was notified by letter of April 21, 1893, th
was annulled "because of failure to commence on the
the contract," and an offer of the Hartford Dredging Co
ford Conn., to do the work at the same rate, 16½ cents, a
May 15, 1893, was accepted. Under this arrangement
begun May 16, 1893, and up to the close of the fiscal ye
yards of sand and mud had been removed, making the
deep at mean low water, with width of 60 feet up to "Tu
distance of about 1,600 feet. A few small boulders wer

PRESENT CONDITION OF IMPROVEMENT

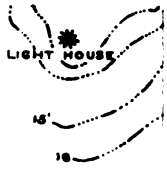
The channel of the West Branch practically retains its
at mean low water, with width from 50 to 80 feet, as
project of 1884.

The channel of the East Branch is as above described
in progress being the only public work of improveme
part of the harbor.

PROPOSED OPERATIONS.

With the available funds it is proposed to make the
East Branch 9 feet deep at mean low water and 60 feet wi
boat Landing, a distance of about 8,500 feet from de
outer harbor. With future appropriations it is propos
this channel and to dredge the channel and basin of the
as described above.

The Annual Report for 1892 contained no estimate for

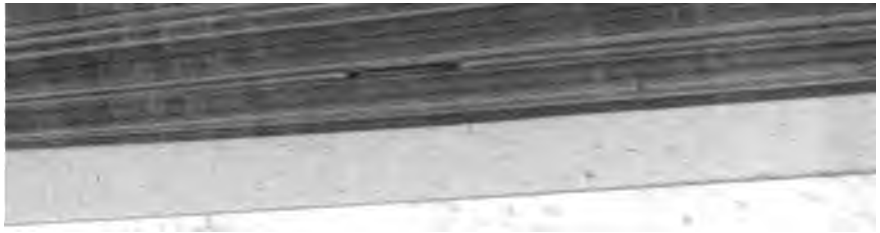


Note:
Projected channels shown by heav
Area dredged 9 feet deep since

To accompany Annual R

Henry M J

Lieut. Col., Corps of E



Application.	Date.	Amount.
Survey	Mar. 2, 1829	$100
Do	Aug. 2, 1882	350
Dredging, West Branch	Aug. 5, 1886	10,000
Do	Aug. 11, 1888	5,000
Do	Sept. 19, 1890	5,000
Dredging, East Branch	July 13, 1892	15,000
Total		35,450

Stamford Harbor is in the Fairfield collection district, of which Bridgeport is the port of entry. There is a light-house on the middle ground at the harbor entrance. The nearest work of defense is Fort Schuyler, Throgs Neck, 20 miles to the southwest.

Money Statement.

July 1, 1892, balance, unexpended		$60.73
Amount appropriated by act approved July 13, 1892		15,000.00
		15,060.73
June 30, 1893, amount expended during fiscal year		965.79
July 1, 1893, balance unexpended		14,094.94
July 1, 1893, outstanding liabilities	$3,572.30	
July 1, 1893, amount covered by uncompleted contracts	9,755.30	
		13,327.60
July 1, 1893, balance available		767.34
Amount (estimated) required for completion of existing project		108,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Stamford Harbor, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, February 2, 1893.

No. of bid.	Name and address of bidder.	Rate per cubic yard, scow measurement.	Amount of bid (50,000 cubic yards).	Remarks.
		Cents.		
1	The Hartford Dredging Co., Hartford, Conn	17⅞	$8,650	
*2	E. R. Seward, Albany, N. Y	16½	8,250	Lowest bid.
3	J. H. Fenner, Jersey City, N. J	19	9,500	
4	Alonzo E. Smith, Islip, N. Y	20	10,000	

* Entered into contract February 25, 1893; contract annulled April 21, 1893, for failure to commence on the day specified.

Commercial statistics for the calendar year 1892.—Vessels arriving and departing.

[Draft 5 to 12½ feet.]

Kind of vessel.	No. of round trips.
Steamers	1,414
Sailing vessels	461
Barges	313
Total	2,188

Freight received and shipped.

Articles.	Tons.	E
Coal	55,421	
Lumber, baryta and building materials	36,459	
Miscellaneous	62,727	
Total	154,607	

No complete data were received for previous years which could be used parison, but 1892 was about a fair average for shipping.

No new lines of transportation have been established since July 1, 1892.

Of the above tonnage about 38 per cent belongs to the West Branch and 62 to the East Branch.

D 17.

IMPROVEMENT OF HARBOR AT COS COB AND MIANUS RIVER, CONNECTICUT.

This harbor is a tidal inlet extending about 2 miles northwardl Long Island Sound at a point 4 miles east of the New York Sta It has a high-water width of from 800 to 2,000 feet, but the low channel is narrow and bounded by mud flats. At low tide ther available depth of 7 feet, with width of about 200 feet for the fir mile, the depth above gradually decreasing to almost zero at th of the harbor.

Mianus is a small settlement at the north end of the inlet; three-quarters of a mile below the stream is crossed by the draw of the New York, New Haven and Hartford Railroad, which has st known as Riverside and Cos Cob, on the east and west banks re ively. The commerce of the harbor is practically confined to th plies of the comunities living along its shores. At Cos Cob, abo railroad bridge, is a shipyard, where a considerable number of boats are repaired and some built; at Riverside, below the brid the houses and docks of the Riverside Yacht Club.

The mean rise of tide is about 7½ feet.

PROJECT FOR IMPROVEMENT.

By act of Congress approved September 19, 1890, a preliminar amination and survey of this harbor were ordered. The report survey, dated July 31, 1891, and printed in the Annual Report Chief of Engineers for 1891, Part I, p. 855, contains plan and est for improvement, to make by dredging a channel of 6 feet depth a low water, 150 feet wide up to the railroad bridge, and 100 fee thence to Mianus, at cost, as follows:

Dredging 160,000 cubic yards, at 20 cents	
Contingencies	
Total	

This project was adopted by approval of the Secretary of War July 21, 1892, after the first appropriation for the improvemer been made.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Seven thousand dollars were appropriated for this work by the river and harbor act approved July 13, 1892; and after duly advertising and receiving proposals for dredging a contract was entered into with Alonzo J. Beardsley, of Bridgeport, Conn., to dredge about 40,000 cubic yards of material at the rate of 15 cents per cubic yard. Work under this contract was begun May 9, 1893, and to the close of the fiscal year 23,953 cubic yards of mud had been dredged from the channel making it 75 feet wide up to the railroad bridge with 25 feet greater width for about half the distance. The depth made was 7 feet at mean low water, that being thought necessary (on account of the softness of the material) in order to retain 6 feet depth. Work is still in progress.

PRESENT CONDITION OF IMPROVEMENT.

The present condition of channel is as above described, this being the first public work of improvement done in Cos Cob Harbor.

PROPOSED OPERATIONS.

With future appropriations, it is proposed to continue dredging in accordance with the approved project.

The only appropriation made for this improvement is that of $7,000 made by the river and harbor act of July 13, 1892, expended as above described.

Cos Cob Harbor and Mianus River are in the collection district of Fairfield, Conn., of which Bridgeport is the port of entry. The nearest light-house is on Great Captains Island, about 3 miles southwest from the harbor entrance. Fort Schuyler, Throgs Neck, New York, 18 miles to the southwest, is the nearest work of defense.

Money statement.

Amount appropriated by act approved July 13, 1892		$7,000.00
June 30, 1893, amount expended during fiscal year		441.44
July 1, 1893, balance unexpended		6,558.56
July 1, 1893, outstanding liabilities	$3,717.95	
July 1, 1893, amount covered by uncompleted contracts	2,407.05	
		6,125.00
July 1, 1893, balance available		433.56
Amount (estimated) required for completion of existing project		29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		20,000,00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for dredging in the harbor at Cos Cob and Mianus River, Connecticut, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1892.

No. of bid.	Name and address of bidders.	Rate per cubic yard, scow measurement.	Amount of bid (30,000 cubic yards).	Remarks.
		Cents.		
1	Hartford Dredging Company, Hartford, Conn	16⅘	$5,070	
2	Charles and H. E. DuBois, New York City	17	5,100	
3	William H. Taylor, Jersey City, N. J	30⅓	9,150	
4*	Alonzo J. Beardsley, Stratford, Conn	15	4,500	Lowest bid.

* Entered into contract October 10, 1892; in progress; contract, expiring June 30, 1893, extended 60 days.

COMMERCIAL STATISTICS.

Commercial statistics for the calendar year 1892 were asked for June 1, 1893, but have not yet been received.

D 18.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

This harbor consists of the lower part of the Byram River and a bay at its mouth opening into Long Island Sound. The river, for about 1¼ miles from its mouth, forms the boundary line between the States of New York and Connecticut. It was formerly navigable to within a few hundred feet of the bridge at Port Chester, a little more than a mile above the mouth.

Before improvement the available depth up to the wharves was about 1 foot at mean low water.

The mean rise of tide is 7.4 feet.

PROJECTS FOR IMPROVEMENT.

A survey of the harbor was made in 1871, and a project for improvement, based on it, was submitted and adopted. The project provided for the removal of two rocks—Sunken Rock, at the entrance to the bay, with 5.7 feet low-water depth, to be removed to 11 feet, and Salt Rock, about 1,000 feet above the mouth of the river, partly bare at low water, to be removed to 9 feet depth; it also provided for a breakwater 400 feet long at Byram Point. The estimated cost was as follows:

Sunken Rock, 1,474.5 cubic yards, at $40	$58,980
Salt Rock, 316.3 cubic yards, at $40	12,652
Breakwater at Byram Point	25,000
Total	96,632

Under this project Salt Rock was removed in 1873. No further work was done until 1884, when a survey of the channel was made under the appropriation of August 2, 1882, and a project for expending the funds available in 1884 (about $16,000), was submitted and approved. It provided for making a channel from 60 to 100 feet wide and 2½ feet deep at mean low water, from the bay to the vicinity of the bridge at Port Chester. The channel was completed to within 150 feet of the bridge in May, 1885.

In 1886, 9,232 cubic yards of sand and gravel were dredged, straightening the channel and removing small lumps and irregularities. Under the appropriation of $5,000, made in 1888, the project was modified to omit the removal of Sunken Rock, and to change the location of the proposed breakwater, making it extend from Sunken Rock toward the shore. Sunken Rock was dangerous only because it was submerged, and was at the side of the channel; the channel width at the rock was ample. A breakwater, with the end on the rock rising some distance above high water, would serve as a beacon, and would be an aid, instead of a danger, to navigation, besides affording more shelter than the originally proposed breakwater; thus it would take the place both of the breakwater and of the removal of Sunken Rock, together estimated to cost $83,980. On account of this modification, in the Annual Report of the Chief of Engineers for 1890, the estimated cost of completion of project was reduced from $64,632 to $25,000.

Up to July 1, 1892, Salt Rock had been removed, a channel 2½ feet deep at mean low water had been dredged up to the Port Chester Highway Bridge, and 585 linear feet of breakwater had been constructed from Sunken Rock toward Byram Point.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Under the appropriation of $5,000 made by act of Congress approved July 13, 1892, proposals for extending and enlarging the breakwater were received, and under date of October 7, 1892, a contract was entered into with Humphrey Toomey, of Guilford, Conn., for furnishing and placing about 3,500 tons of riprap at the rate of $1.24 per gross ton. Delivery of stone under this contract was begun December 30, 1892, and up to the close of the fiscal year 1,985 tons had been delivered, of which 896 tons were used in extending the breakwater shoreward about 198 linear feet, and 1,089 tons were used in enlarging about 500 feet of the old work. By terms of the contract the enlargement is not to be accepted until the extension is completed. Work is still in progress; the contract expires September 30, 1893.

PRESENT CONDITION OF IMPROVEMENT.

Salt Rock has been removed to a depth of 9 feet at mean low water. The breakwater at Byram Point has been made 783 feet long.

An available channel 2½ feet deep at mean low water has been dredged to a point 150 feet below the bridge; thence to the bridge the width is 25 feet. In front of the wharves, where vessels lie aground at low tide, the bottom has been leveled as nearly as practicable.

PROPOSED OPERATIONS.

With future appropriations it is proposed to complete the breakwater at Byram Point and to maintain and, if necessary, to deepen the river channel.

Appropriations for improvement of Port Chester Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Removing Salt Rock	June 10, 1872	$12,000
Dredging in Byram River and Bay	Aug. 2, 1882	15,000
Breakwater	Aug. 11, 1888	5,000
Do	Sept. 19, 1890	5,000
Do	Jny 13, 1892	5,000
Total		42,000

Port Chester Harbor is in the collection district of New York.

The nearest light-house is on Great Captain Island, 1¼ miles east of the mouth of the harbor.

The nearest work of defense is Fort Schuyler, Throgs Neck, about 15 miles southwest.

Money statement.

July 1, 1892, balance unexpended	$612.02
Amount appropriated by act approved July 13, 1892	5,000.00
	5,612,02
June 30, 1893, amount expended during fiscal year	1,284.78

July 1, 1893, balance unexpended		$4,327.24
July 1, 1893, outstanding liabilities	$2,055.85	
July 1, 1893, amount covered by uncompleted contracts	1,878.60	
		3,934.45
July 1, 1893, balance available		392.79

Amount (estimated) required for completion of existing project 15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for construction of breakwater at Port Chester Harbor, New York, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 27, 1892.

No. of bid.	Name and address of bidder.	Rate per ton.	Amount of bid (2,500 tons).	Remarks.
*1	Humphrey Toomey, Guilford, Conn	$1.24	$3,100.00	Lowest bid.
2	S. and E. S. Belden, Hartford, Conn	1.72	4,300.00	
3	John A. Bouker, New York City	1.75	4,375.00	Proposal not signed.
4	William C. Whyte, New York City	1.93½	4,837.50	
5	John Voorhis, Greenwich, Conn	1.50	3,750.00	
6	Brown & Fleming, New York City	1.50	3,750.00	

* Entered into contract October 7, 1892, for about 3,500 tons; in progress. The contract expires September 30, 1893.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

These were promised, but have not yet been received. They would probably differ little from those reported for 1891, which were as follows:

Arrivals and departures of vessels.

[Draft, 5½ to 9 feet; tonnage, 25 to 300 tons.]

	No. of round trips.	Tonnage.
Steamers	550	60,000
Sail vessels	400	22,000
Barges	600	125,000
Total	1,550	207,000

Freight received and shipped by water.

	Tons.	Estimated value.
Receipts	143,000	$1,100,000
Shipments	28,000	900,000
Total	171,000	2,000,000

The above figures show an increase in tonnage of freights since 1890 of 11,000 tons.
The principal articles of commerce by water are manufactured goods, coal, iron, farmers' produce, and general merchandise.
No new lines of transportation have been established since July 1, 1892.

D 19.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

Larchmont Harbor is a bay on the northwest shore of Long Island Sound, about 25 miles by water from the Battery, New York City, and 6 miles southwest from the boundary between the States of New York and Connecticut. The harbor is about half a mile wide and extends rather more than half a mile inland; it is a basin with no definite channel, the low-water depth of 18 feet at the entrance gradually decreasing towards the shores, east, north and west.

The harbor is chiefly used by the Larchmont Yacht Club, but is more or less sought by small coasters and fishing vessels for refuge or for night anchorage. It is exposed to storms from east to south, and during northeast storms heavy seas roll around Long Beach Point, east of the harbor, and compel vessels to go well up into shoal water for shelter.

The entrance is divided into three channels by two rocks: Umbrella Rock, about 800 feet from the west shore, being a large ledge with least depth of 3.1 feet at mean low water, and Huron Rock about 900 feet southwest from the east shore, a smaller ledge with least depth of 9.8 feet. The channel between the rocks is over 900 feet wide, and is the one almost invariably used. There are other rocks inside the harbor which are well known and are marked by spindles; they are too near the west shore to interfere with the use of the harbor for general navigation.

The mean rise of tide is 7.4 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of August 11, 1888, provided for a survey of Larchmont Harbor, which was made the following year. The report on the survey, dated November 26, 1889, was printed as House Ex. Doc. No. 40, Fifty-first Congress, first session; and also in the Annual Report of the Chief of Engineers for 1890, Part I, p 675. With the report were presented two alternative projects for improvement, one for removal of Umbrella and Huron rocks, the other for breakwaters to cover each rock and extend to the nearest shore. The cost of removing the rocks to 15 feet depth at mean low water was estimated at $126,000 and the cost of the two breakwaters at $105,000. At the date of the report the preference of those most interested in the harbor was expressed in favor of removing the rocks; after further consideration they changed their views, preferring the breakwaters, and, in accordance with their petition or request, a clause in the first draft of the river and harbor act of 1890 which required that the money appropriated for the harbor be expended "to remove obstructions at mouth of harbor" was struck out.

The project for constructing two breakwaters at the mouth of the harbor was approved by the Secretary of War September 27, 1890, after the first appropriation for improving the harbor was made.

Up to July 1, 1892, 74 linear feet of Umbrella Breakwater and 64 linear feet of Huron Breakwater had been built.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Nothing was done.

PRESENT CONDITION OF IMPROVEMENT.

The only public work done in this harbor is the beginning of construction of two breakwaters. Umbrella Breakwater has been made 74 feet long and Huron Breakwater 64 feet long. Both were begun upon the rocks and were built to 10 feet above low water, with top width of 4 feet, the outer ends being slighly higher to serve as beacons on the rocks. At their present lengths they serve no other purpose than to mark the rocks.

PROPOSED OPERATIONS.

Future appropriations should be applied to completing both breakwaters, as provided for in the project.

The only appropriation for improving Larchmont Harbor, New York, is the one of $5,000 made by act of Congress approved September 19, 1890.

Larchmont Harbor is in the collection district of New York. The nearest lighthouse is on Execution Rock, 3 miles southward. Fort Schuyler, about 8 miles southwest, is the nearest work of defense.

Money statement.

July 1, 1892, balance unexpended	$120.95
July 1, 1893, balance unexpended	120.95
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

These were asked for, but have not yet been received.

The figures would presumably differ little from those reported for 1891, which were as follows:

Number of yachts entering harbor during 1891 (estimated)		2,200
Draft of these yachts	feet	3 to 13
Tonnage of these yachts	tons	3 to 400
Number of vessels other than yachts entering harbor for refuge or for night during 1891 (estimated)		250
Draft of such vessels	feet	4 to 10
Tonnage of such vessels	tons	10 to 300

Freight discharged in Larchmont Harbor in 1891.

Number of cargoes	30
Amount in tons	2,000

Vessels owned by Larchmont Yacht Club.

[Draft, from 3 to 13 feet; tonnage, 6 to 300 tons; total tonnage, 5,000 tons.

Steamers	43
Schooners	38
Sloops	86
Smaller boats	87
Total	254

No new lines of transportation have been established since July 1, 1892.

D 20.

IMPROVEMENT OF EAST CHESTER CREEK, NEW YORK.

East Chester Creek, called also Hutchinson River, is a small stream which, as a tidal inlet for the last 4 miles of its course, traverses marshes of one-quarter to one mile in width and empties into East Chester or Pelham Bay, a large bay on the northwest shore of Long Island Sound, just east of Throgs Neck, and 20 miles by water from the Battery, New York City. The width of the creek varies from 25 feet to a half mile at high water, but the channel is narrow everywhere.

Pelham Bridge, a highway bridge, crosses the creek near its month. A short distance above is the bridge and trestle of the Harlem River branch of the New York, New Haven and Hartford Railroad, and at Lockwood, about 2¼ miles above its mouth, the stream is crossed by the Boston road. All three bridges are draw bridges.

The mean rise of the tide at the mouth of the creek is 7.1 feet.

For half a mile up the creek there was originally a channel from 4 to 9 feet deep at low water, but the depth decreased farther up, and at Town Dock, the principal landing, about 1½ miles from the mouth, the available depth at high water was only about equal to the rise of the tide. Above Town Dock the stream was narrow and crooked and the depth about the same as just below.

The commerce at Town Dock was principally in coal and building materials for East Chester and Mount Vernon; the latter is a rapidly-growing place with a present population of about 14,000. The main part of the city of Mount Vernon is about 2 miles from Town Dock. It is understood to be mainly for the benefit of prospective Mount Vernon commerce that the improvement of East Chester Creek is desired.

PROJECTS FOR IMPROVEMENT.

In 1871 a survey of East Chester Creek was ordered by Congress. It was made in the same year, and in the report, dated January 19, 1872, and printed in the Annual Report of the Chief of Engineers for 1872, p. 812, three plans of improvement were outlined, viz:

For making and maintaining, by means of a tidal basin and a system of dikes, a channel 9 feet deep at mean low water, estimated to cost $1,646,000.

For making and maintaining in the same way a channel 11 feet deep at mean high-water (about 4 feet at low water), estimated to cost $731,000.

For securing 7 feet depth at slack-water navigation by means of a lock above Goose Island (about half a mile from the mouth of the creek), estimated to cost $300,000.

No recommendation as to the worthiness of improvement accompanied these estimates. March 25, 1872, the House of Representatives passed a resolution inquiring the cost of removing obstructions between tide-gauges No. 1 and No. 2, so as "to afford the same depth of water above Station No. 1 as now prevails below it."

In reply to this resolution a report was submitted April 3, 1872 (see Annual Report of Chief of Engineers for 1872, p. 814), containing the following estimates:

Basin, purchase of site, 18 acres, at $150	$2,700
Excavation to level of mean low water, 200,000 cubic yards, at 40 cents	80,000
Excavation of cut, 60,000 cubic yards, at 40 cents	24,000
Diking and revetting banks of cut	12,000
Engineering and contingencies	17,805
Total	136,505

This plan contemplated (as appears from map
the channel at Lockwood and, as it was neces
place the old arch bridge of the Boston road b
ing the location of such bridge to a point abou
as to give a straighter and cheaper channel for t

In 1873 $25,000 was appropriated for improvi
It was designed to expend it in accordance wit
which were then considered an adopted proje
been provided for acquiring the land needed
Lockwood, so no work was done at that time.

In 1875 it became apparent that the propose
the drawbridge at Lockwood could not be made.
the boundary between the towns of East Cheste
supported by the towns jointly. Under the pr
tion the new bridge would lie within the town
would then have to support it; therefore the to
consent to the change, and the old bridge was re
bridge in the same location. The proposed loc
therefore, to be altered to bring it to the draw
tated excavating a considerable amount of rock
$10,000. (See Gen. Newton's letter to the Chie
ber 24, 1875.)

In 1875, $12,000 more was appropriated for
it was not until 1877 that a commission, appoint
York, finally obtained the land for the proposed
of way was secured, in 1877, a contract was ent
cut 9 feet deep at mean high water (2 feet at lo
of 100 feet at high-water level; this contract
cubic yards of rock excavation, 1,210 linear fe
linear feet of crib dike. It was completed in
and in 1879, under an appropriation of $10,00
dredging was done by hired labor, removing a
outside of Pelham Bridge, and making a chan
and 9 feet deep at high water on the west side
an extension of the original project.

In 1879 $3,500 was appropriated for continuin
$3,500 in 1880. These appropriations were not

In the Annual Report for 1879 it was stated as
the improvement from Pelham Bridge to Loc
dikes from the lower end of the cut to Goose
5,800 feet." In 1880 these dikes were estimated

The appropriations were not large enough to
cut above Lockwood or the above-mentioned dik
works were apparently abandoned for the time
Newton, U. S. Engineers, then in charge, report

Furthermore, until it is proved that a depth of 9 or 1
maintained under the scale of improvement already compl
to inaugurate new works. The amount of funds availa
sufficient for the present wants of the case.

This money was expended in 1884 in dredging
a work not included in the original estimate.

August 5, 1886, $10,000 were appropriated for t
was mostly expended in 1888 and 1889 in dredgi
and Lockwood, to remove shoals from the previ

In 1887 an estimate was made of the cost of t
tensions of project, from which it appears that $

expended or estimated for works not included in the first estimate, and that estimate, therefore, should be increased to $221,000 if it is proposed to carry out the original plan with these extensions.

It was proposed to expend the appropriation of $5,000 made August 11, 1888, in dredging a cut above Lockwood, and in January, 1889, the line of cut was staked out and a description given to the State commissioners for securing right of way. They were asked to obtain permission to deposit the material on the marsh lands adjacent to the cut, which could be done cheaply as compared with the cost of carrying it out into Long Island Sound. The commissioners reported that this consent could not be obtained; and as the available funds were not sufficient to begin work under any other plan for disposing of dredged materials, work was postponed until larger appropriations should be made.

Up to July 1, 1892, no work had been done above Lockwood. The channel below Lockwood had an available depth of 9 feet at mean high water, with widths from 50 to 125 feet, and was used by such commerce and freight as could be conveniently discharged at Town Dock and at Lockwood.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

With the available balance of previous appropriations dredging was begun to extend the channel above Lockwood by open market transaction, that method being most economical and advantageous to the Government. An offer of the Mount Vernon Suburban Land Company, to do the required dredging and to deposit the material upon adjacent banks at the rate of 22 cents per cubic yard, prism measurement, was accepted, with approval of the Chief of Engineers, dated September 26, 1892. Dredging was begun November 21, 1892, and completed April 22, 1893, 27,700 cubic yards of mud being dredged and deposited on the west side of the cut. The channel was made 9 feet deep at mean high water, 60 feet wide at the bottom, with side slopes of 1 upon 1, extending northward for a distance of 1,300 feet above the drawbridge at Lockwood. The upper 1,000 feet of this distance was mainly through the salt meadows, the natural channel being too crooked for navigation.

The Mount Vernon Suburban Land Company had acquired title to, or control of, the meadows as far up as the cut extended; they have graded off the dredged deposits to a height of about 4 feet above mean high water, and have built a dock front along the west side of the cut for about 1,000 feet length.

PRESENT CONDITION OF IMPROVEMENT.

There is a channel of 9 feet depth at mean high water (2 feet at low water) from the bay to a point 1,300 feet above Lockwood, with width of 100 feet or over to a point 1,000 feet above Town Dock; thence to Lockwood from 50 to 75 feet wide, and above Lockwood 60 feet wide.

The dikes on the east side of the channel below Lockwood are in fair condition.

PROPOSED OPERATIONS.

With future appropriations it is proposed to widen the channel below Lockwood and to widen and deepen it above Lockwood, as

Dredging from 40 to 90 feet wide from Pell Point to Town Dock	Mar. 3, June 14,
Dredging above Town Dock	Aug. 5,
Dredging above Lockwood	Aug. 11,
Total	

East Chester Creek is in the collection district of New York.

The nearest light-house is on the "Stepping Stones," 3 miles sou mouth of the creek.

The nearest work of defense is Fort Schuyler, Throgs Neck, about 3½

Money statement.

July 1, 1892, balance unexpended....

June 30, 1893, amount expended during fiscal year....

July 1, 1893, balance unexpended....

Amount (estimated) required for completion of existing project....
Amount that can be profitably expended in fiscal year ending June 30, 18
Submitted in compliance with requirements of sections 2 of river a harbor acts of 1866 and 1867 and of sundry civil act of March 3, 18

Commercial statistics for the calendar year 1892.

These were asked for but have not yet been received. The figu sumably not vary much from those reported for 1891, which were as fo

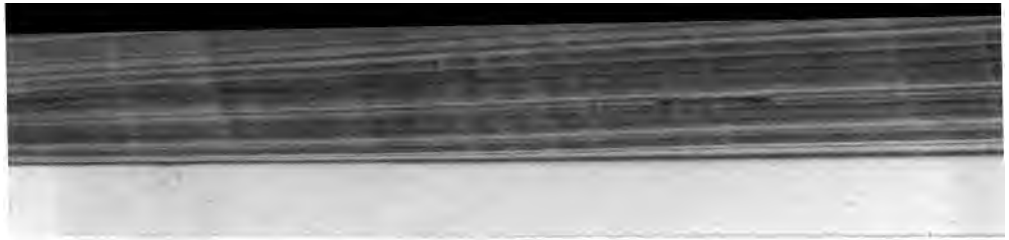
Arrivals and departures of vessels.

Schooners....
Sloops....
Barges....
Total....

Freight received and shipped.

Lumber....
Building material....
Stone....
Water pipe (iron)....
Coal....





PROPOSED OPERATIONS.

Under the existing contract it is proposed to continue dredging to increase the anchorage area inside the breakwater. This will complete the project for improvement.

Appropriations for improving Greenport Harbor have been made as follows:

Application.	Date.	Amount.
Survey	Mar. 3, 1881	$500
Expended on breakwater	Aug. 2, 1882	10,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	5,000
Do	Aug. 11, 1888	5,000
Breakwater and dredging	Sept. 19, 1890	5,000
Dredging	July 13, 1892	11,000
Total		46,500

Greenport is a port of delivery in the collection district of Sag Harbor.

The nearest light-house is on Long Beach Point, 3 miles to the eastward.

The nearest work of defense is Fort Trumbull, New London Harbor, Connecticut, 21 miles distant in a straight line.

Money statement.

July 1, 1892, balance unexpended		$192.91
Amount appropriated by act approved July 13, 1892		11,000.00
		11,192.91
June 30, 1893, amount expended during fiscal year		1,352.43
July 1, 1893, balance unexpended		9,840.48
July 1, 1893, outstanding liabilities	$1,351.18	
July 1, 1893, amount covered by uncompleted contracts	6,919.20	
		8,270.38
July 1, 1893, balance available		**1,570.10**

Abstract of proposals for dredging in the harbor of Greenport, N. Y., opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 27, 1892.

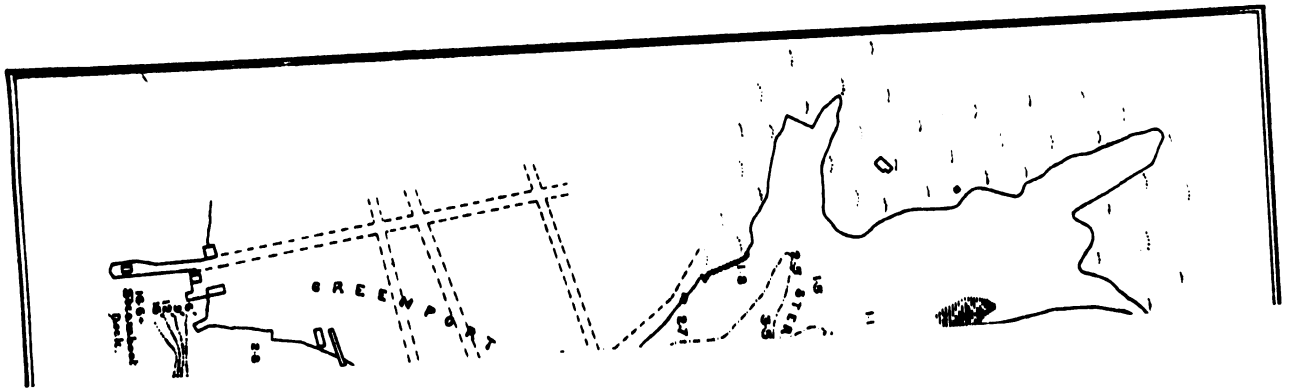
No. of bid.	Name and address of bidder.	Rate per cubic yard, scow measure.	Amount of bid (45,000 cubic yards).	Remarks.
		Cents.		
*1	P. J. Brummelkamp, Syracuse, N. Y.	20	$9,000	Lowest bid.
2	The Hartford Dredging Company, Hartford, Conn.	21	$9,450	

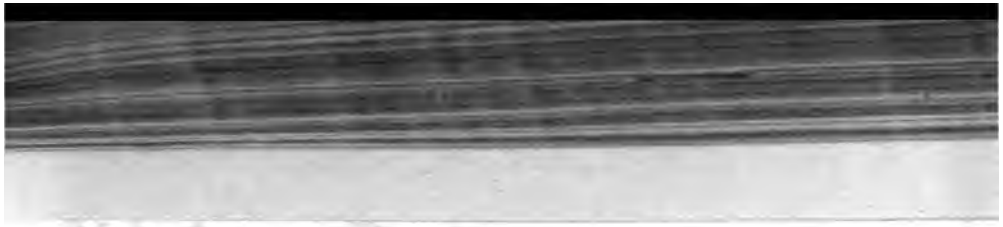
*Entered into contract October 12, 1892; in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

These were asked for June 1, 1893, but have not been received.

The last statement of commerce received for Greenport Harbor was for the calendar year of 1890, when 43,500 tons of freight were reported.


GREENPORT



D 22.

IMPROVEMENT OF PORT JEFFERSON HARBOR, NEW YORK.

Port Jefferson Harbor is on the north shore of Long Island and about 50 miles east from New York City. It is a mile long and averages three-quarters of a mile wide, and a large part of the area has a depth of 18 feet or more at low tide. Tributary to this harbor, on the west, are Setauket Harbor and Conscience Bay, two shallow tidal basins. Port Jefferson Harbor is surrounded on three sides by hills, and is separated from Long Island Sound on the north by a beach of sand and gravel, through which, and nearly in the axis of the harbor, is a single entrance 400 feet wide. This entrance is Port Jefferson Inlet, and through it a tidal reservoir of 2 square miles area receives and discharges some 300,000,000 cubic feet of water with every tide, producing a current whose maximum velocity exceeds 4 miles per hour. In that narrow part of the inlet the depths have always been considerable, but a short distance out into the Sound was a broad, flat bar, which originally had a depth of 4 feet at low water; until the beginning of Government improvement in 1871 the location of the inlet had been shifting; since 1838 it has moved westward 790 feet, an average annual rate of 24 feet.

The village of Port Jefferson, with a population of about 3,000, lies at the head or south end of the harbor. The mean rise of tides at the village wharves is 6.2 feet; in Long Island Sound, outside the inlet, it is 7 feet. The difference is wholly in the low-water levels.

PROJECTS FOR IMPROVEMENT.

A survey of the harbor was made in 1853 by Lieut. Harrison, U. S. Engineers. In 1870 an examination was ordered by Congress. The first project for improvement was submitted by Gen. Warren, January 16, 1871, after an examination, and provided for building a jetty on the east side of the entrance, extending out to the 9-foot curve and rising to 11 feet above mean low water, to be built partly of dimension stone; also for dredging a channel 200 feet wide and 7 feet deep at mean low water through the bar. (See Annual Report of the Chief of Engineers for 1871, p. 805.) The estimated cost was as follows:

Construction of jetty	$150,125
Dredging	15,000
Total	165,125

When the project was adopted under the appropriation of March 3, 1871, it was provided that the jetty should be of riprap, rising only to the level of mean high water, except between the high and low water marks on the beach, where it was to be carried to the level of the highest tides; but no change was made in the estimates. Under this appropriation 600 feet of the jetty were built, and under the appropriation of June 10, 1872, it was extended to 1,052 feet. An estimate made in 1873 of the cost of completion ($35,000) made the estimate for the whole project $65,000. In 1875 a modification of the project, based on the observed effect of the jetty, was made, providing for a jetty on the west side of the entrance, about 1,075 feet long and rising 4 feet above mean high water, designed to increase the force of the tidal currents. The width of the channel was also reduced to 100 feet. No new estimate was submitted at the time, but in 1877, after about $8,000

had been expended on the west jetty, it was estimated that $12,250 would be required to complete it, or $20,250 in all. A revised estimate, made in the same year for the whole improvement, contemplated extending the east jetty to the 9-foot curve, extending the west jetty 600 feet farther, and dredging a channel 100 feet wide and 8 feet deep (this increase of depth on account of increased draft of vessels using the harbor), at an estimated cost of $34,000; $45,000 had then been appropriated and nearly expended, making the total estimate from the beginning $79,000 (including $6,000 appropriated in 1876 and then unexpended). This estimate was incorrectly reported in 1878, but was reverted to in 1879, and repeated in each subsequent annual report. In 1877 one cut 25 feet wide and 8 feet deep was dredged through the bar. The channel was dredged to a width of 100 feet under the appropriation of March 3, 1879. In 1877 the east jetty was raised to a height of 5 feet above mean high water and extended 50 feet. In 1878 the west jetty was extended 450 feet, but the height was made only 2 feet above mean low water, except the outer end and an intermediate point, which were raised to 4 feet above mean high water, to serve as guides.

Between 1879 and 1883 both jetties were extended and repaired, making their respective lengths 1,390 feet for the east jetty and 940 feet for the west jetty. This completed the then existing project.

By act of Congress of August 11, 1888, an examination of Port Jefferson Inlet was ordered. A preliminary examination was found sufficient with recent Coast Survey charts for all required purposes, and with the report on this examination, dated December 5, 1888, and printed in the Annual Report of the Chief of Engineers for 1889, Part I, p. 751, were presented plans and estimates for making and maintaining channels through the inlet of 10 and 12 feet depth, respectively. The 10-foot channel was considered by interested parties as sufficient for present needs. The estimates in detail were as follows:

For a channel 10 feet deep and 200 feet wide:	
Repairing and enlarging east jetty	$34,200
Repairing and enlarging west jetty	18,150
Dredging	25,390
Contingencies, say	12,260
Total	90,000

Commencement of work under this project for 10 feet depth was approved by the Secretary of War November 1, 1890, after an appropriation had been made for "the project to give a channel 10 feet deep and 200 feet wide."

Up to July 1, 1892, the east jetty had been enlarged as required for its whole length outside high-water mark, and about 250 linear feet of the west jetty, at its outer end, had been enlarged; dredging had been begun on the 10-foot channel at the inlet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the date of the last Annual Report dredging to make a 10-foot channel through the inlet had been begun, under a contract with Richard Parrott, to dredge about 40,000 cubic yards of material at the rate of 21½ cents per yard. Work was continued until August 12, 1892, when the contractor became financially involved, and after efforts to clear himself finally decided that he was unable to go on with the work. With approval of the Chief of Engineers, dated October 19, 1892, his contract was allowed to expire by limitation on December 1, 1892. The amount dredged under this contract during the past fiscal year was

July 1, 1893, balance unexpended
July 1, 1893, outstanding liabilities
July 1, 1893, amount covered by uncompleted contrac

July 1, 1893, balance available

{Amount (estimated) required for completion of exis
Amount that can be profitably expended in fiscal year
Submitted in compliance with requirements of sect
harbor acts of 1866 and 1867 and of sundry civil a

Abstract of proposals for dredging in the harbor at Port
by Col. D. C. Houston, Corps of Engineers, at New Y

No. of bid.	Name and address of bidder.	E ya n
1	Elijah Brainard, New York City.....	
2	The Hartford Dredging Co., Hartford, Conn.....	

Bids rejected as being too high.

Abstract of proposals for dredging in the harbor at Port
by Col. D. C. Houston, Corps of Engineers, at New Y

No. of bid.	Name and address of bidder.	E ya n
1	Elijah Brainard, New York City	
2	Morris & Cummings Dredging Co., New York City...	
3	Hartford Dredging Co., Hartford, Conn	
4	J. H. Fenner, Jersey City, N. J.....	
5	Alonzo E. Smith, Islip, N. Y	
6	E. R. Seward, Albany, N. Y	

Bids rejected as being too high.

Abstract of proposals for dredging in the harbor at P
opened by Col. D. C. Houston, Corps of Engineers, at Ne

No. of bid.	Name and address of bidder.	E ya n
1	E. R. Seward, Albany, N. Y.....	
*2	J. H. Fenner, Jersey City, N. J.....	
3	Alonzo E. Smith, Islip, N. Y.....	
4	The Hartford Dredging Co., Hartford, Conn.....	

*Entered into contract February 6, 1893; still in progress; cont

the head or south end of the harbor the orig
and decreasing in depth to zero at low tide.

Huntington village lies about a mile south o
it has 4,000 to 5,000 population.

The mean rise of tide is 7.2 feet.

PROJECTS FOR IMPROVEM

By act of Congress, approved March 3, 1871
was authorized. It was made in that year, a
December 11, 1871, and printed in the Annua
Engineers for 1872, p. 907), was submitted an
cost of dredging out a shoal at the entrance to
ing the 8-foot channel 150 feet wide for abou
wharf, the property of the town.

By act of Congress of June 10, 1872, $22,
the harbor, and the project for improvement
1873, the outer shoal being removed to 8 feet
nel being extended 2,200 feet to the old town
feet was, however, reduced to 130 feet in the
account of exhaustion of funds. It had beer
most of the dredged material on the flats in t
of much local opposition this was abandoned
had been dumped there, and the rest of the d
posited in deep water in Long Island Sound.
91,786 cubic yards.

The river and harbor act of July 5, 1884,
amination of this harbor. A survey was ma
port of which (printed in the Annual Report
for 1885, Part I, p. 703, *et seq.*) contains a pla
taining the depth of 8 feet, made by dredging
sequently lost by settling of the banks, with e
ing the channel up to the old town dock, as f

Dredging 84,000 cubic yards at 25 cents per cubic yard
Pile protection, 1,400 linear feet, at $5 per linear foot .

Superintendence and contingencies.....

Total.....

with an estimate of additional cost of $10,00
carry the channel up to the last wharf on th
800 feet farther.

The beginning of work under this project
retary of War, November 3, 1890, after an
provement had been made by Congress.

Up to July 1, 1892, the channel of 8 feet dep
been dredged 90 feet wide up to within 60
upper landing in the harbor, a total distanc
bend in the channel, the width for 400 feet ha

OPERATIONS DURING THE FISCAL YEAR

The river and harbor act approved July 13,
for continuing this improvement. After adv
proposals for dredging, a contract, dated Nov

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Arrivals and departures of vessels.

[Draft, 5 to 8 feet; tonnage, 70 to 400 tons.]

Kind of vessels.	No. of round trips.	Tonnage.
Steamers	195	78,000
Sailing vessels	420	75,000
Barges	12	5,376
Total	627	158,976

Freight received and shipped by water.

	Tons.	Estimated value.
Receipts	31,000	$650,000
Shipments	13,000	270,000
Total	44,000	920,000

No new lines of transportation have been established since July 1, 1892.

The deepening of the channel has enabled the daily steamer from here to New York City to make landing a half mile or more farther up the harbor, and so much nearer the center of population and business—a great saving in time and money as to passengers and freight. In the lumber and coal business on the east side freight is now landed at the yards from the vessels, where formerly it had to be taken by lighters—a great saving. Vessels large and small now arrive and depart from the upper docks, while before the improvement they had to await the rise of tide, and the accruing advantages are very great. Our people are greatly pleased with the work that has been done. It is, however, greatly desired that the channel may be widened as a protection against filling in from the sides and safety and convenience of navigation.

D 24.

IMPROVEMENT OF GLEN COVE HABBOR, NEW YORK.

Glen Cove Harbor is a small estuary or creek opening into the east side of Hempstead Bay, Long Island, about 1¾ miles from Long Island Sound and about 27 miles by water from the Battery, New York City. The channel in the creek is about 2 feet deep at mean low water, and a bar at the entrance has a foot less depth. Vessels entering Glen Cove Harbor have to wait for high tide, anchoring in Hempstead Bay, where they are exposed to storms from the north and northwest. When such storms are heavy it is impossible to tow over the bar, and from this cause vessels have been obliged to remain in the bay for three or four days exposed to heavy seas.

The mean rise of tide in this harbor is 7.7 feet.

PROJECT FOR IMPROVEMENT.

The act of Congress approved August 5, 1886, provided for a survey or examination of Glen Cove Harbor. A preliminary examination was all that was deemed necessary, and upon this, with the assistance of the U. S. Coast Survey charts recently published, a report with estimates

of cost of improvements was presented, dated December 7, 1886, and printed in the Annual Report of the Chief of Engineers for 1887, Part I, p. 645.

The plan of improvement described in this report contemplated a breakwater about 2,500 feet long and extending in a general westerly direction from Mosquito Point on the east side of Hempstead Bay and north of the entrance to Glen Cove Inlet, the breakwater to be built of riprap, the top to be 5 feet wide and 3 feet above high water, with side slopes of 1 upon 1, at an estimated cost as follows:

136,000 tons of riprap, at $1.35 per ton	$183,600
Contingencies, 10 per cent	18,360
Total	201,960

This project was adopted in 1888, an appropriation being made by Congress for beginning the work, and the location of the shore end of the breakwater was definitely fixed to be at the northwest corner of the Glen Cove Dock and its course to be west-southwesterly toward Mott Point.

Up to July 1, 1892, 1,056 linear feet of the breakwater had been built to a height of 1 foot above high water, with top width of 3 feet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Ten thousand dollars were appropriated for continuing this improvement by act of Congress approved July 13, 1892. After advertising for and receiving proposals, a contract dated October 4, 1892, was entered into with Brown & Fleming, of New York City, to enlarge and extend the breakwater by furnishing and placing about 13,000 tons of stone at the rate of 69 cents per ton.

Work under this contract was begun December 8, 1892, and up to the close of the fiscal year 8,250 tons of gneiss had been placed in the work, enlarging it to 3 feet top width at 4 feet above high water for a length of 1,000 feet.

The contract expires August 30, 1893.

PRESENT CONDITION OF IMPROVEMENT.

The breakwater is now 1,056 feet long and has been enlarged to 3 feet top width at a height of 4 feet above high water for 1,000 feet of this length.

PROPOSED OPERATIONS.

Under the existing contract it is proposed to enlarge the breakwater for the rest of its length and to extend it about 50 linear feet.

Future appropriations should be applied to further extending the breakwater, as provided by the approved project.

Appropriations for improving Glen Cove Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Breakwater	Aug. 11, 1888	$20,000
Do	Sept. 19, 1890	15,000
Do	July 13, 1892	10,000
Total		45,000

Glen Cove Harbor is in the collection district of New York; the nearest lighthouse is on Sands Point, about 4 miles west; Fort Schuyler, New York Harbor, the nearest work of defense.

Money statement.

July 1, 1892, balance unexpended		$237.37
Amount appropriated by act approved July 13, 1892		10,000.00
		10,237.37
June 30, 1893, amount expended during fiscal year		3,442.32
July 1, 1893, balance unexpended		6,795.05
July 1, 1893, outstanding liabilities	$3,417.17	
July 1, 1893, amount covered by uncompleted contracts	3,277.50	
		6,694.67
July 1, 1893, balance available		100.38
Amount (estimated) required for completion of existing project		156,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of proposals for constructing breakwater at Glen Cove Harbor, New York, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 27, 1892.

No. of bid.	Name and address of bidder.	Rate per ton.	Amount of bid (6,000 tons).	Remarks.
1	Humphrey Toomey, Guilford, Conn	$1.24	$9,920	
2	John A. Bouker, New York City	.85	6,800	
*3	Brown & Fleming, New York City	.69	5,520	Lowest bid.

*Entered into contract October 4, 1892; in progress; contract expires August 30, 1893.

Commercial statistics for Glen Cove Harbor have been asked for, but have not yet been received.

D 25.

IMPROVEMENT OF FLUSHING BAY, NEW YORK.

Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The town of Flushing is on the east bank of Flushing Creek, just above the head of the bay. The bay is about 1 mile wide and 2 miles long; the bottom is of soft mud, nearly level; the depth in the original channel being not much greater than elsewhere. In 1861 a depth of 5 feet at low water was reported in the channel leading up to Flushing. At the beginning of the improvement by the United States the depth there was but 3.9 feet. The mean rise of tide is 7.1 feet.

PROJECTS FOR IMPROVEMENT.

A survey of Flushing Bay was made in 1878, and a project for improvement based upon the survey was proposed and adopted. This project provided for constructing two dikes, the first to extend northerly

from the head (or south end) of the bay along the west side of the channel, then, bending, to continue westward to Herrick Point, at the west side of the mouth of the bay, thus forming a large tidal basin, which should fill and discharge through the main channel; the second to start from a point near the middle of the east shore and extend northwardly to the 6-foot curve, confining the channel. It also provided for dredging to make and maintain a channel 6 feet deep at mean low water. The estimated cost of this work was as follows:

Constructing 4,400 linear feet of pile dike, at $10 per foot	$44,000
Constructing 7,800 linear feet of pile dike, at $9 per foot	70,200
Constructing 900 linear feet of pile dike, at $7.50 per foot	6,750
Constructing 3,600 linear feet of single piling, at $3.70 per foot	13,320
For 83,000 cubic yards of dredging, at 20 cents per cubic yard	16,600
Contingencies	22,630
Total	173,500

All the timber work of the dike was to be creosoted.

The first appropriation was expended in building 3,057 linear feet of pile dike on the west side of the channel, extending northward from near the head of the bay. Subsequent appropriations until 1888 were expended in dredging to make and maintain the required channel depth, it being found necessary to dredge repeatedly in the same places. The total amount of material dredged in this period was about 235,000 cubic yards.

In September, 1888, a modification of the original project was approved, which provided for "extending the dike northward and towards the west side of the channel at College Point, and for dredging, omitting the dikes running westerly to Herrick Point, and the single row of piles on the east side." In 1891, owing to strong opposition to the dike by a large number of property owners at Flushing, College Point, and Newtown, further work upon it was discontinued, and the project was modified to provide for maintaining the channel by dredging only.

Up to July 1, 1892, 4,663 linear feet of the dike had been built. The channel, which had been repeatedly dredged, had nearly the required depth of 6 feet at mean low water, with width of about 90 feet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act of 1892 appropriated $10,000 for continuing this improvement. Proposals for dredging were invited, by advertisement, to be opened September 27, 1892. A single bid was received at 35 cents, which was rejected as being too high and the work was readvertised. Proposals were opened December 16, 1892, and under date of January 11, 1893, a contract was entered into with Chas. & Henry Du Bois, of New York City, to dredge about 30,000 cubic yards, at the rate of 28 cents per yard. Work under the contract was begun April 29, 1893, and completed June 3, 1893—31,378 cubic yards of material being dredged. At the bend of the channel at the south end of the dike a shoal was removed and the channel widened to 100 feet for a length of about 1,600 feet; north of the north end of the dike the channel dredged in 1891 was extended 1,400 feet to deep water in the mouth of the bay, with width of 70 feet; and at the head of the harbor just below the Wagon Bridge a cut of about 100 feet width was made through a shoal of sand, gravel, and stones, removing four large bowlders averaging about four tons each, and several smaller stones.

along the sides; in 1891, about 200 linear feet of the piling remained, but badly injured; the riprap could be traced for nearly the whole length of the work, but no trace of the dredged channel remained.

The mean rise of tide at Patchogue River is 1.1 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of June 4, 1880, provided for a survey of the river, which was made that year; the report, dated October 30, 1880, and printed in the Annual Report of the Chief of Engineers for 1881, Part I, p. 674, contained estimates for a plan of improvement, as follows:

The estimate to secure a depth of 6 feet at mean low water by dredging in the river, and from its mouth to the 6-foot curve in the bay is	$21,000
For diking, from river to 6-foot curve in bay	15,800
Engineering, contingencies, etc., 15 per cent	5,520
Total	42,320

One dike was to be on the west side of the river's mouth, and another and shorter one on the east side; the total length of the two to be about 2,400 feet, to be of carbolized timber filled with riprap, and to be from 5 to 7 feet wide from out to out.

Nothing had been done toward the desired improvement, and in 1886 another examination (ordered by the river and harbor act of that year) was made.

The report on this examination is printed in the Annual Report of the Chief of Engineers for 1887, Part I, p. 759. This report contained a project and estimates for dredging a channel 60 feet wide and 6 feet deep from the Highway Bridge at Patchogue (4,000 feet above the mouth of the river) to the 6-foot curve in Great South Bay, a total length of about a mile, and to protect the channel in the bay by a dike or jetty on its west side 1,700 feet long; the plan also mentioned the possible necessity of a dike on the east side, but it was not included in the estimates, which were as follows:

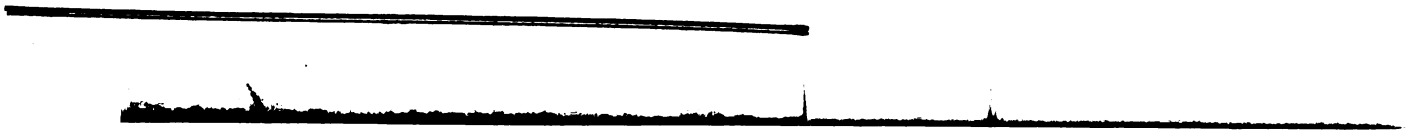
Dredging from the head of navigation at the bridge to the 6-foot contour in Great South Bay, the channel being 60 feet wide and 6 feet deep, would require the removal, by scow measurement, of about 60,000 cubic yards of sand, at 30 cents per cubic yard	$18,000
Diking 1,700 linear feet, at $10 per linear foot	17,000
Superintendence, contingencies, etc	5,000
Total	40,000

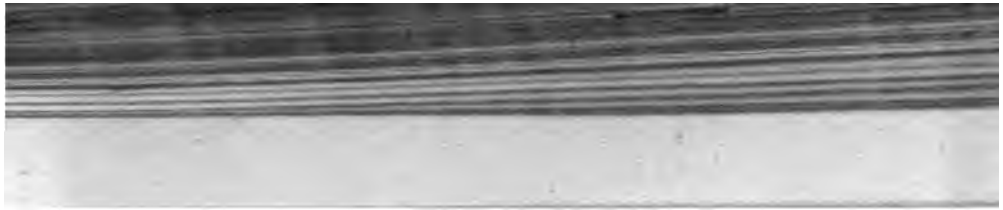
Beginning of work under this project was approved by the Secretary of War, October 4, 1890, after the first appropriation for the improvement had been made.

Up to July 1, 1892, the jetty had been built 1,340 feet long, terminating in 4½ feet depth of water; the top was 1 foot above high water and 3 feet wide. The dredged channel which had been made 50 feet wide and 6 feet deep at mean low water to a point 350 feet inside the shore end of the jetty, had shoaled considerably, especially along the edges, from subsidence of the very soft banks.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act of 1892 appropriated $8,000 for continuing this improvement. Proposals for dredging were received, and a contract for dredging and placing upon adjacent banks about 20,000





cubic yards of material, prism measurement, at 34 cents per yard, was entered into with Alonzo E. Smith, under date of October 7, 1892. Under this contract dredging was begun April 3, 1893, and completed June 6, 1893. Twenty thousand cubic yards of material were removed and placed upon the east bank, dredging a channel 1,426 feet long, extending northward from the dredged channel of 1891 to and across Gilberts Point: the point on the east side of the river's mouth was cut off, widening the entrance channel by 85 feet; above that entrance the channel was made 60 feet wide and a middle ground between the Government channel and one dredged by private parties was dredged out.

PRESENT CONDITION OF IMPROVEMENT.

The channel from Great South Bay to the mouth of the river, dredged 50 feet wide and 6 feet deep in 1891, has shoaled so that the available depth is now scant 5 feet at mean low water; above the entrance to Gilberts Point, the depth is fully 6 feet and width from 60 to 150 feet, partly dredged at private expense. Above Gilberts Point, the available depth to the head of the stream is 3½ feet, though it is considerably deeper in places, the result of private dredging.

The jetty is in fair condition; it was damaged slightly by ice during the past winter, but not so as to urgently need repair.

PROPOSED OPERATIONS.

Future appropriations should be applied to completing the dredged channel and extending the jetty.

Appropriations for improving Patchogue River, New York, have been made as follows:

Application.	Date.	Amount.
Constructing jetty and dredging	Sept. 19, 1890	$15,000
Dredging	July 13, 1892	8,000
Total		23,000

Patchogue River is in the collection district of New York. The nearest lighthouse is at Fire Island Inlet, 14 miles southwest. The nearest work of defense is Fort Hale, New Haven Harbor, Connecticut, about 35 miles in a direct line northward.

Money statement.

July 1, 1892, balance unexpended	$1,258.99
Amount appropriated by act approved July 13, 1892	8,000.00
	9,258.99
June 30, 1893, amount expended during fiscal year	5,078.82
July 1, 1893, balance unexpended	4,180.17
July 1, 1893, outstanding liabilities	2,798.39
July 1, 1893, balance available	1,381.78
Amount (estimated) required for completion of existing project	17,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	17,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging in Patchogue River, New York, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1892.

No. of bid.	Name and address of bidder.	Rate per cubic yard (25,000 cubic yards approximate).	Amount of bid.	Remarks.
		Cents.		
*1	Alonzo E. Smith, Islip, N. Y	34	$8,500	

* Entered into contract October 7, 1892; contract completed June 6, 1893.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Arrivals and departures of vessels.

[Draft from 4 to 9 feet; tonnage from 10 to 500 tons.]

Steamers	100
Sail vessels	800
Barges	300
Total	1,200

Freight received and shipped by water.

	Tons.	Estimated value.
Received	100,000	$1,250,000
Shipped	20,000	350,000
Total	120,000	1,600,000

Number of vessels built and repaired, 1892.

	No.	Tonnage.
Built	30	10 to 100
Repaired	150	10 to 400

No new lines of transportation have been established since July 1, 1892.

The report for 1892 shows an increase in tonnage of freight over the figures reported for 1891 of 15,000 tons.

D 27.

IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, N. Y.

Browns Creek is a small stream flowing midway between the villages of Sayville and Bayport, near the south shore of Long Island, and emptying into Great South Bay, about 11 miles northeast of Fire Island Inlet. From Fire Island Inlet to the vicinity of Browns Creek there is a rather crooked channel of about 8 feet available depth. The original entrance to the creek was crooked, narrow, and shifting. Its depth at mean low water was about .4 foot. In the stream itself

the low-water level was from .3 to 1.3 feet higher than low water in Great South Bay, and the channel depths from zero to 3 feet below low water in the bay. The width of the stream from the bay to the Highway Bridge, about 5,000 feet, averages 77 feet. Its course lies through a sandy marsh from one-quarter to one-half mile in width, separated from the bay by a low and narrow beach. In its natural condition this stream was not available for any purpose of navigation.

The permanent population of Sayville is said to be 3,500.

The mean rise of tide in Great South Bay is 1.1 feet; at the Highway Bridge, except in dry seasons, it is scarcely noticeable.

PROJECT FOR IMPROVEMENT.

In pursuance of the river and harbor act of August 11, 1888, a survey of Browns Creek was made, the report on which was printed in House Ex. Doc. No. 22, Fifty-first Congress, first session; and also in the Annual Report of the Chief of Engineers for 1890, Part I, pp. 669–674. With this Report plans and estimates for work were presented as follows:

The object of the desired improvement is to secure an anchorage ground or place where the fishing boats can lie in safety during rough weather. This can be accomplished by widening and deepening the creek and improving its mouth. To prevent the entrance from filling up by drift and wave action, jetties will probably be needed on both sides, certainly on the west side, as the drift of sand along the shore is from west to east. The jetties should be of riprap, the top and slopes to be of stone weighing not less then one-fourth ton, the top to be 3 feet wide, and 1 foot above high water, with slopes of 1 on 1. The stone on the top and slopes should be selected and carefully laid, so as to present as smooth a surface as possible, to resist the action of the moving ice.

The cost of dredging a channel 100 feet wide and 6 feet deep at mean low water from the 6-foot curve in the bay up to the first bend in the creek (1,850 feet) is estimated to be:

33,000 cubic yards, at 30 cents per cubic yard, the material to be deposited in the bay	$9,900
For a 4-foot channel 100 feet wide above this point to the Highway Bridge, 4,680 feet, 86,000 cubic yards, at 14 cents per cubic yard, the material to be placed on the banks	12,040
Cost of west jetty, 1,600 feet long, 3,700 cubic yards of riprap, at $2.50 per cubic yard	9,250
Cost of east jetty, 1,400 feet long, 3,100 cubic yards of riprap, at $2.50 per cubic yard	7,750
Contingencies	7,060
Total	46,000

The first work to be done should be the deepening at and near the mouth, and the construction of jetties, commencing at the shore end. These works should be carried on simultaneously.

This improvement would not only benefit those engaged in oystering and fishing, but would enable many articles of commerce to be brought to Sayville by water, instead of by rail, as at present. A partial improvement would be of great benefit to small vessels.

The beginning of work under this project was approved by the Secretary of War, October 4, 1890, after the first appropriation for improving Browns Creek had been made; up to July 1, 1892, 492 linear feet of the west jetty and 275 feet of the east jetty had been completed, and 175 feet additional of the east jetty partly built, and a channel 1,450 feet long, 100 feet wide and 4 feet deep had been dredged from deep water in Great South Bay, extending about 1,150 feet inside the mouth of the creek.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the date of the last Annual Report a contract with E. Bailey & Sons for construction of jetties was in force, and not completed. During August, 1892, 273 tons of stone were placed in the east jetty, and accepted, and part of the stone in the extreme outer end was removed and used to build the rest of the work to full dimensions; the completed work was thus extended from 275 feet to 438 feet length. The outer end was also made 2 feet higher than the rest of the work, to serve as a temporary beacon.

Under the appropriation of $5,000 made by act of Congress approved July 13, 1892, after advertising for and receiving proposals a contract was entered into with Alonzo E. Smith for dredging about 12,000 cubic yards of mud, prism measurement, and depositing it upon adjacent banks, at the rate of 34 cents per cubic yard. Work was begun in December, 1892, and the contract completed April 12, 1893, 12,000 cubic yards having been dredged.

The channel dredged in the previous year was deepened for practically its whole length, to remove shoals, and was extended northward 443 feet, making its total length 1,893 feet, with width of 100 feet, and depth of 4 feet at mean low water.

PRESENT CONDITION OF IMPROVEMENT.

The west jetty has been made 492 feet long and the east jetty 438 feet long, with top widths of 3 feet at height of 1 foot above mean high water. Both jetties are in fair condition; they suffered slight damage from ice during the past winter, but not sufficiently to require immediate repairs. The dredged channel as yet retains its full dimensions, as made under the contract recently completed. It is used freely for night anchorage by small oyster boats owned and operated in the vicinity, and the anchorage area has been extended by two branches dredged into the east marsh by private parties.

PROPOSED OPERATIONS.

Future appropriations will be applied to maintaining and extending the channel, and to completing the jetties, as contemplated in the approved project.

Appropriations for improving Browns Creek have been made as follows:

Application.	Date.	Amount.
Constructing jetties and dredging	Sept. 19, 1890	$12,000
Dredging	July 13, 1892	5,000
Total		17,000

Browns Creek is in the collection district of New York.

The nearest light-house is at Fire Island Inlet, about 11 miles southwest.

The nearest works of defense are the fortifications at Willets Point, New York, about 35 miles west, and Fort Hale, New Haven Harbor, Connecticut, about the same distance northeastwardly.

Money statement.

July 1, 1892, balance unexpended	$1,471.40
Amount appropriated by act approved July 13, 1892	5,000.00
	6,471.40
June 30, 1893, amount expended during fiscal year	6,095.57
July 1, 1893, balance unexpended	375.83
Amount (estimated) required for completion of existing project	29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for dredging in Browns Creek, New York, opened by Col. D. C. Houston, Corps of Engineers, at New York City, September 26, 1892.

No. of bid.	Name and address of bidder.	Rate per cubic yard (15,000 cubic yards) approx.	Amount of bid.
		Cents.	
*1	Alonzo E. Smith	34	$5,100

*Entered into contract October 7, 1892; contract completed April 12, 1893.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1892.

Draft of vessels using harbor, from 2 to 5 feet.

Number of oyster boats and small vessels belonging in the harbor (estimated)	250
Amount of oysters taken during the year by vessels belonging in the harbor (estimated bushels)	240,000
Number of vessels (estimated) using the harbor for shelter, or for night, which could not have used it before improvement, over	200

I know of no actual count of the number of vessels observed at one time in the harbor, but the number must have considerably exceeded 115 during the early winter.

No new lines of transportation have been established since July 1, 1892.

SAYVILLE, LONG ISLAND, N. Y., *June 17, 1893.*

DEAR SIR: In addition to the statistics furnished above (which are in accordance with the best estimates obtainable), I beg to direct attention to the following memoranda:

1. During the year 1892 there were actually laid out by the town authorities four highways approaching this harbor and affording more ready public access to it than had previously been enjoyed.
2. Private enterprise in connection with the improvement continued and 300 feet of private canal were dug, forming an arm of the harbor.
3. Oyster-shipping establishments continued to center about the mouth of the creek, as offering the best commercial advantages in this vicinity.
4. The past winter being unusually severe, the Great South Bay was twice frozen over from shore to shore so solidly that at one time for a fortnight or more teams with loaded sleighs crossed and recrossed daily. During these times nearly all the shipping of this neighborhood was safely harbored in the creek. When the ice broke up it piled upon the shore and about the jetties at the mouth of the harbor to a height of 20 to 30 feet, and it would be difficult to estimate (hardly possible to overestimate) the damage which the shipping of this part of the bay would have sustained had it not been for the safe refuge which this improvement, even in its present incomplete condition, afforded.

Very respectfully, yours,

JOSEPH WOOD,
On behalf of the Village Improvement Society of Sayville and Bayport.

D 28.

PRELIMINARY EXAMINATION OF WESTPORT HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 114, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated November 1, 1892, by Col. D. C. Houston, Corps of Engineers, of the results of a preliminary examination of Westport Harbor, Connecticut, made to comply with requirements of the river and harbor act approved July 13, 1892.

This harbor is regarded by Col. Houston as worthy of improvement by the General Government, and I concur in his views. He estimates that the survey necessary to the preparation of plan and project for improvement proposed will cost $500.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF COL. D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., November 1, 1892.

GENERAL: I have the honor to submit the following report on preliminary examination of Westport Harbor, Connecticut, made in pursuance of the river and harbor act approved July 13, 1892.

This harbor comprises the portion of the Saugatuck River, Connecticut, below Westport. I made a report on this harbor, dated January 8, 1891, under the head of "preliminary examination of Saugatuck River, Connecticut," which was printed in the Annual Report of the Chief of Engineers for 1891, p. 840.

I reported that the harbor was worthy of improvement, for the reasons stated in that report, a copy of which is forwarded herewith.*

* * * * * * *

The river and harbor act approved July 13, 1892, appropriated $7,000 for "improving the Saugatuck River, Connecticut, to be expended in the improvement of the natural channel." In addition to the matters above mentioned, it is found that the breakwater or sea wall on Cedar Point needs some repairs * * * which would come under the head of improving the natural channel, as the object of the wall is to prevent the wearing away of the point which protects the entrance to the harbor.

It is represented that the entrance to the harbor is shoaling by sand washing over the point, but the extent of this and the remedy, if any, can only be determined by a survey. It may probably be advisable to extend the breakwater beyond the point. There is also a ledge rock in the middle of the river opposite Stony Point, with a least depth of 3½ feet at mean low water. While there is sufficient depth on either

*Omitted.

side, the existence of the rock is a menace to navigation. The cost of removal will necessitate a detailed survey.

I am of opinion that this harbor is worthy of improvement by the General Government, and would therefore submit an estimate of $500 for a survey to determine what further improvements are necessary, and to make a project and estimate of cost.

No complete survey of this harbor has been made since 1872.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

D 29.

PRELIMINARY EXAMINATION OF NORWALK HARBOR, CONNECTICUT.

[Printed in House Ex. Doc. No. 82, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated November 3, 1892, by Col. D. C. Houston, Corps of Engineers, on preliminary examination of Norwalk Harbor, Connecticut, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Col. Houston, concurred in by this office, that Norwalk Harbor is worthy of improvement by the General Government.

It is estimated that $500 will be required for surveys necessary to preparation of plan and project for improvement proposed.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF COL. D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., November 3, 1892.

GENERAL: I have the honor to submit the following report on preliminary examination of Norwalk Harbor, Connecticut, made in pursuance of the river and harbor act of July 13, 1892:

There has been appropriated for the improvement of this harbor, from 1872 to 1890, inclusive, the sum of $83,000, which has been expended in dredging a channel 100 feet wide and 8 feet deep at mean low water up to South Norwalk, and thence to Norwalk 60 to 100 feet wide and 6 feet deep; and in additional dredging to repair and maintain these channels.

Of the total amount appropriated it is estimated that 36 per cent ($30,000) has been expended in maintaining the channel.

The channel had been wholly completed to dimensions stated above by the fall of 1885, and some parts had been redredged; appropriations since 1885 have been wholly applied to maintenance.

The originally projected width of 100 feet above South Norwalk was reduced to 60 feet on account of the large cost of maintenance, owing to small annual appropriations. When the improvement was commenced by the United States the low-water depth to South Norwalk was 5 feet and to Norwalk but 1 foot.

The project heretofore contemplated has been practically completed, but further improvements are now desired by the people of Norwalk and South Norwalk.

It is necessary, in the first place, that the present channel be maintained, and it is also desirable that certain sharp bends be cut off, so as to give greater ease to navigation, as follows:

At the entrance to the harbor, south of Keysers Point, where the channel is very tortuous.

Above this point to the railroad bridge it is desirable that the channel be straightened and widened.

For the location of these points I would refer to the U. S Coast and Geodetic Survey chart of "Entrances to the Norwalk and Saugatuck rivers," issued April, 1888, which extends up to the railroad bridge.

Above the bridge to the head of navigation, a distance of 1½ miles, periodical dredging will also be necessary to maintain and widen the channel. The location of this portion of the harbor is shown on the accompanying blue print.*

* * * * * * *

It is also suggested by the Norwalk Board of Trade that a "channel should be ultimately dredged through the flat below Jennings to South Norwalk in a substantially straight course, avoiding the crooked and much longer channel around Oyster Shell Point." The location is shown approximately by the dotted red line A——C on the blue print. This is a work of considerable magnitude, which does not appear to be necessary at present. It involves the acquisition of a right of way through private property, which, however, it is stated, can be obtained without cost to the United States. Borings would be needed to ascertain whether a channel at this locality would require rock excavation. This project would probably meet with opposition from the owners of property on the east side of the existing channel, which would doubtless suffer from the proposed cut.

I am of opinion that this harbor is worthy of improvement by the General Government. It is but the continuation of a useful improvement commenced in 1872 and continued up to 1891.

The Annual Report of 1892 gives the following statistics for the calendar year ending December 31, 1891, which are the latest I have been able to obtain:

Arrivals and departures of vessels.

[Draft, 7 to 12 feet. Tonnage, 100 to 500 tons.]

Kind of vessels.	No. of round trips.
Steamers	a 1,051
Sail vessels	475
Barges and canal boats	600
Total	2,126

a I think it would be perfectly fair to add to this report, say, 100 trips each of 10 oyster steamers, with an average cargo of 40 tons each, at an average value of $10 per ton, or 1,000 trips—40,000 tons at $400,000.

* Not printed.

Cargoes.

Articles.	Tons.	Estimated value.
Coal	100,000	$400,000
Lumber (16,000,000 feet)	18,500	390,000
General merchandise	250,000	15,000,000
Total	368,500	15,790,000

The above figures show an increase in freight tonnage of 56,000 tons over that reported for 1890.

One new line of transportation has been established since July 1, 1891.

I submit an estimate of $500 for a survey for the purpose of making a project and estimate of cost of further improvements.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

D 30.

PRELIMINARY EXAMINATION OF BERRIANS CREEK, LONG ISLAND, NEW YORK.

[Printed in House Ex. Doc. No. 80, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated November 1, 1892, by Col. D. C. Houston, Corps of Engineers, of the results of a preliminary examination of Berrians Creek, Long Island, New York, made to comply with provisions of the river and harbor act approved July 13, 1892.

Col. Houston is of opinion that the creek is not worthy of improvement by the General Government, and I concur in his views.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF COL. D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., November 1, 1892.

GENERAL: I have the honor to submit the following report on preliminary examination of Berrians Creek, Long Island, New York, made in pursuance of the river and harbor act of July 13, 1892.

This creek, which is not named on the published charts, is a small tidal branch of the East River, New York, on the north shore of Long Island, 3 miles north and east from Hell Gate by channel, as shown on the attached tracing.* Berrians Island, at the mouth of the creek, divides the outlet into two channels, one extending northwesterly to East River, the other easterly to Bowery Bay. Originally the creek was about a mile long, extending southwesterly from the entrance for about 2,000 feet, thence eastwardly nearly to Bowery Bay; the creek was bordered by salt meadows. Recent improvements have resulted in filling up and grading part of these meadows and of the creek, so that now it is about 2,000 feet long. Its original condition is shown on the U. S. Coast and Geodetic Survey Chart of the western end of Long Island Sound, published in 1855 and issued in 1878. The mean rise of tide is 7 feet.

In the creek proper the bed is bare nearly everywhere at ordinary low tide, and the width at high water ranges from 40 to 150 feet, the bottom being mud.

In the northwest entrance channel, the mean low water depth near the mouth of the creek is 2½ feet for a short distance, when it increases to over 10 feet, and thence to deep water in East River there is apparently no place where a depth of 6 feet can not be found in the channel. This entrance channel is narrow, somewhat crooked, and at the outer end has a bottom of coarse gravel, with perhaps some cobbles. Elsewhere it is of mud of different degrees of hardness or light sand. The entire length of this entrance from deep water in East River to the mouth of the creek is 4,500 feet.

In the east entrance the channel depth is 3 to 3½ feet for a distance of 2,000 feet from the mouth of the creek to deep water outside of Bowery Bay. This channel is not well defined, having but slightly greater depth than the extensive mud flats on either side. The bottom of the channel is also mud.

The improvement desired is the securing of a channel sufficient to admit at ordinary high water the vessels which bring the coal and materials used for the settlement known as "Steinway," the upper part of Long Island City. The desired depth and width are reported to be 14 feet depth at high water (7 feet at mean low water) and 80 feet width, except in the upper part of the creek, where 40 to 60 feet would suffice.

* * * * * * *

The business which would be benefited by such an improvement is conducted at four docks, all on the right (east) bank of the creek, three near the mouth and one about 1,000 feet inland, as follows, in order from the mouth upstream: Oakes Manufacturing Company, wood dyes, etc., Astoria Veneering Company, Steinway Piano Factory, coal yards of George H. Smith, and the supplies of the Steinway and Hunters Point Railroad Company, and the Astoria Silk Works.

This is represented as amounting in total to about 161,000 tons last year, of which over two-thirds is coal and lumber. Interested parties estimate that the annual tonnage would be doubled if the channel were improved as desired.

A considerable part of the freight received is lightered in New York Harbor, because the vessels bringing it can not approach the wharves at any stage of tide. Vessels for Berrians Creek are generally towed through the East River and to the docks, and the entrance used is uniformly the east channel. There is an impression among towboat cap-

*Not printed.

tains that the northwest channel is dangerous on account of rocks. The preliminary examination indicates that there are no rocks there which could not easily be avoided, but no survey of the locality has been made in greater detail than the U. S. Coast and Geodetic Survey Chart, East River from Lawrence Point to Throgs Neck, scale $\frac{1}{10000}$, issued 1888.

I inclose herewith a communication from Mr. W. H. Williams, president of the Astoria Veneering Works, giving statistics of tonnage.

While there is a large amount of business done at Steinway and a prospect of increase by the rapid development of the surroundings of New York City, I do not consider that the improvement asked for would be of any public benefit. It would reduce somewhat the cost of freight on materials shipped to and from the locality, but would not probably affect the cost to consumers of the articles manufactured there. From the information obtainable, I am of opinion that the creek is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

LETTER OF MR. W. H. WILLIAMS, PRESIDENT OF THE ASTORIA VENEER MILLS.

ASTORIA VENEER MILLS,
New York, October 8, 1892.

DEAR SIR: Complying with your request to furnish statistics as to the proximate amount of tonnage per year 1891, received at Steinway, Long Island, that would, if Berrians Creek was deepened, come through that channel, are as follows:

	Tons.
Total amount of tonnage received by Steinway & Sons, per annum	4,000
Shipments, per annum	2,000
Francis J. Oaks Manufacturing Co., present tonnage per day:	
Received	50
Delivered	22
With the improvement of Berrians Creek it would amount to daily	130
Steinway and Hunters Point Railroad received last year (freight)	6,000
Astoria Silk Works last year (freight)	3,000
George H. Smith, last year (freight)	25,000
Astoria Veneer Mills:	
Received (per annum)	60,000
Delivered (per annum)	40,000

The depth required at low water would be 7 feet. With this improvement to the creek it would allow that portion of Long Island a ferry slip, as the College Point Ferry Company would give us a landing there. It would also enable us to bring in vessels that now have to be unloaded and their cargoes brought in by lighter altogether.

The names of the manufacturers on this list with the proposed improvement of Berrians Creek would double the tonnage per annum.

Hoping that you will give this your consideration, I remain,

Respectfully yours,

W. H. WILLIAMS.

ENGINEER OFFICE, U. S. ARMY.

D 31.

PRELIMINARY EXAMINATION OF SOUTHOLD HARBOR, LONG ISLAND, NEW YORK.

[Printed in House Ex. Doc. No. 48, Fifty second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated November 2, 1892, from Col. D. C. Houston, Corps of Engineers, of the results of a preliminary examination of Southold Harbor, Long Island, New York, made to comply with provisions of the river and harbor act approved July 13, 1892.

I concur in the opinion of Col. Houston that the locality is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF COL. D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., November 2, 1892.

GENERAL: I have the honor to submit the following report on preliminary examination of Southold Harbor, Long Island, New York, made in pursuance of the river and harbor act of July 13, 1892.

This harbor (so termed) is simply a private landing place or wharf on the west side of Southold Bay in the eastern part of Long Island. The wharf is 500 feet long, extending southeasterly from the shore. The natural depth at the head of the wharf is about 5 feet at mean low water and it is about 750 feet farther out to a depth of 12 feet. Some years ago a channel 10 feet deep or more and 100 feet wide was dredged up to the wharf by private parties. A recent examination shows that there is at present a depth of 10 feet and a width of about 50 feet. The wharf is used as a regular landing for the Sag Harbor and New York steamers, and has been frequently used as such by the New London and Sag Harbor boats. All steamers have to back out, as there is not channel room to turn at the end of the wharf, and the New London boats, which are screw boats, do not readily do this.

What is desired is to have the channel widened to 150 or 200 feet, with 12 feet depth, and a turning basin made at the end of the wharf, so that vessels can go out without backing. This locality is of considerable importance as a point for receiving supplies and shipping farm products, the nearest landing place for steamers being at Greenport, about 4½ miles distant. It does not seem to me that the improvement desired is a proper one to be undertaken by the United States. The difficulty can be remedied by extending the wharf to deeper water with better results than by dredging. In either case, I consider the improvement a matter of private enterprise, and am therefore of opinion that the locality is not worthy of improvement by the General Government.

The locality is shown on the chart of Long Island Sound, published by the U. S. Coast and Geodetic Survey.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Col. Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

D 32.

ESTABLISHMENT OF HARBOR LINES IN SHAWS COVE, NEW LONDON HARBOR, CONNECTICUT.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., January 20, 1893.

GENERAL: The work of improvement in that portion of New London Harbor, Connecticut, known as Shaws Cove, directed by the river and harbor act of July 13, 1892, having been commenced, it becomes necessary to establish harbor lines, in order to define precisely the area of the ultimate improvement and to fix the limit beyond which wharves, etc., shall not extend.

Parties interested have asked me for information on this point, and I have accordingly, after full consultation with all property owners and others interested, laid out harbor lines as shown on the accompanying tracing,* which I would recommend for approval. The object of this improvement is to make a basin where vessels can be laid up in winter and to afford additional facilities for commerce.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 23, 1893.

Respectfully submitted to the Secretary of War.

Col. D. C. Houston, Corps of Engineers, the officer in local charge of the improvement of Shaws Cove, New London Harbor, Connecticut, in the within report states the necessity of establishing harbor lines in Shaws Cove, and submits the accompanying tracing, upon which are delineated the pierhead and bulkhead lines recommended for approval by the Secretary of War under the provisions of the act of September 19, 1890.

It is recommended that the lines proposed be approved and that the Secretary place his approval both upon this report and the tracing submitted.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

WAR DEPARTMENT,
Washington. D. C., January 26, 1893.

Approved as recommended by the Chief of Engineers.

S. B. ELKINS, *Secretary of War.*

*Not printed.

D 33.

ESTABLISHMENT OF HARBOR LINES IN BRIDGEPORT HARBOR, CONNECTICUT.

BRIDGEPORT, CONN., *April 16, 1891.*

The undersigned represent that Bridgeport is the principal port of entry for the customs district of Fairfield in the State of Connecticut, and that the United States Government has for the past few years expended large sums of money in the widening, deepening, and improving said Bridgeport Harbor, so as to render it navigable for vessels of heavy burden and deeply laden to enter our said harbor at all conditions of the tides; and

Whereas parties owning or occupying lands adjoining said Bridgeport Harbor are in the act of, or are intending, to fill in upon the mud flats and encroach upon said harbor, so as to seriously affect and injure the rights of navigation by the pressure of material from the flats bordering on the channel, and thus to a certain extent preventing the use of said harbor;

Now, therefore, the undersigned citizens and taxpayers of said city of Bridgeport and owners of land adjoining said harbor respectfully request that you will cause an examination to be made of the condition of said harbor, and, if deemed expedient, to cause a harbor line to be run and established on the east side of our said harbor, known as Pequonnock River, from the drawbridge of the New York, New Haven and Hartford Railroad to Long Island Sound, beyond which no wharf, dock, or other obstruction shall be erected, built, or allowed to exist, or to take such steps as you may deem fit and proper to prevent encroachments upon the rights and needs of navigation and for easy and free use of said port as a harbor for anchorage and a harbor for refuge for large tows that frequent the same, and as in duty bound your petitioners will ever pray.

CHARLES R. BROTHWELL,
President, Board Trade.

And 25 others.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 6, 1891.

Respectfully referred to Col. D. C. Houston, Corps of Engineers, for report.

To be returned.

H. M. ADAMS,
Major, Corps of Engineers, in charge.

[Third indorsement.]

NEW YORK, *May 8, 1891.*

Respectfully returned to the Chief of Engineers. No harbor lines have been established at Bridgeport Harbor by the Government. Lines have been established by the city, which have been changed from time to time. I understand that at present there is difficulty in agreeing on the lines by the parties interested. In view of this and the importance of Bridgeport Harbor I would respectfully suggest that harbor lines

be established on both sides of the harbor from Long Island Sound to the head of navigation, a distance of about 3 miles, under the provisions of the river and harbor act approved September 19, 1890.

D. C. HOUSTON,
Colonel, Corps of Engineers.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 9, 1891.

Respectfully returned to the Secretary of War.

The president of the board of trade, and others of Bridgeport, Conn., request that harbor lines be established at Bridgeport, under the provisions of the river and harbor act approved September 19, 1890.

This paper was referred to Col. D. C. Houston, Corps of Engineers, the officer in charge of the improvement of Bridgeport Harbor, and his report is contained in the third indorsement, to which attention is invited.

It is recommended that a board of officers to consist of Col. D. C. Houston, Lieut. Col. G. L. Gillespie, and Capt. Thos. L. Casey, of the Corps of Engineers, be constituted to consider and report upon the subject of harbor lines at Bridgeport, on both sides of the harbor, from Long Island Sound to the head of navigation, as suggested by Colonel Houston, the board to meet at Bridgeport, Conn., on the call of the senior member, and its expenses to be paid from appropriation for improving Bridgeport Harbor.

With the sanction of the Secretary of War, the order constituting the board will be issued from this office.

H. M. ADAMS,
Major, Corps of Engineers, in charge.

[Fifth indorsement.]

WAR DEPARTMENT, *May 11, 1891.*

Approved as recommended by the officer in charge of the office of the Chief of Engineers.

By order of the Acting Secretary of War:

JOHN TWEEDALE,
Chief Clerk.

REPORT OF BOARD OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, January 4, 1892.

GENERAL: The Board of Engineers constituted by special orders No. 29, Headquarters Corps of Engineers, U. S. Army, dated May 12, 1891, has the honor to submit the following report:

A petition, dated Bridgeport, Conn., April 16, 1891, signed by Charles R. Brothwell, president of the Bridgeport Board of Trade, and others, requesting the establishment of harbor lines on the east side of Bridgeport Harbor, was referred to the Board for consideration and report, including the entire harbor from the head of navigation to Long Island Sound.

The Board met at Bridgeport at 11 a. m., June 1, 1891, and at once made an examination of the harbor in a steamer, accompanied by William

H. Marigold, mayor of Bridgeport, Capt. John McNeil, harbor master, Charles R. Brothwell, president of the board of trade, Peter W. Wren, chairman board of public works, and president of board of education, H. G. Scofield, city engineer, and others, representing the petitioners.

At 2 p. m. a meeting was held at the city hall, about 30 persons being present. The petition asking for the establishment of harbor lines and the order constituting the Board were read, whereupon counsel representing certain riparian owners protested against any action by the Board in the matter. Time was asked to present their case; and the Board, after hearing a number of statements, adjourned to meet at some time to be afterward determined.

Soon after a written protest against the establishment of harbor lines at Bridgeport by the Secretary of War was handed to the senior member of the Board by counsel representing riparian owners, together with the opinion of the state court in the case of Farist *vs.* The City of Bridgeport (copy herewith). After consultation with the other members of the Board, these papers were forwarded to the Chief of Engineers with the statement that the counsel desired a hearing before the Secretary of War, or his legal adviser, on the legal questions involved. The papers were returned with instructions that the hearing should be had by the Board. After due notice to all parties interested, the Board met at city hall in Bridgeport, on July 14. The riparian owners and the petitioners were represented by counsel, and statements were made by a number of persons. The counsel for the riparian owners presented a brief remonstrating against the establishment by the Board "of any harbor line other than that already established by the municipal authorities, and for cause of such remonstrance say, generally, that this Board ought not to act in the matter."

The counsel for the petitioners promised to send a reply to the Board as soon as practicable. This has been received, and is forwarded herewith with the other papers in the case.

Having obtained all the information possible, the Board met in New York City October 23, 1891.

It appears that in 1886, harbor lines were established in Bridgeport Harbor by the city authorities, under the laws of the state of Connecticut, extending from the head of navigation to Long Island Sound. These lines were modified in the same year, so as to include a strip 100 feet wide on each side of the Stratford Avenue Bridge, extending on the east side, from the harbor line to the drawbridge, as indicated on the tracing herewith. It is understood that this change was to authorize the existence of certain buildings adjacent to the bridge and was made in accordance with a contract between the city of Bridgeport and parties interested (see brief of parties in interest, p. 9). It is claimed by the petitioners that these lines are not legal, for reasons stated in their brief.

In 1889 the city authorities laid out a line on the east side between Nichols street and the site of the steel works, some little distance inside the line of 1886, the details of which are not in possession of the Board. This line was objected to by parties interested, and the State courts decided that the changes were invalid (see opinion in the Farist Steel Company *vs.* The City of Bridgeport, herewith), and that no such change could be made without compensation to owners.

As the matter now stands it appears that the lines laid out in 1886 on the east side are satisfactory to all parties, except as to the lines above and below the bridge and parallel thereto, and the line on the east side between the bridge and the Farist Steel Company's property.

It is now asked by the petitioners that these portions of the line be taken into consideration by the Board.

The Board thinks that it is unfortunate that any harbor lines should have been drawn around the Lower (or Stratford Avenue) Bridge, east of the draw, which authorized the contraction of the already small harbor space on either side of the bridge at that point, and while it is impracticable at this time to correct the evil, that the new line should be so drawn as to prevent future encroachments.

The part of the harbor between the Lower Bridge and the point of the Farist Steel Company's property, about 16½ acres, is very much crowded by oyster vessels and other small craft which use it as a harbor of safety and obstruct the main channel. As a remedy for this condition of affairs, it has been proposed to push the harbor line below the bridge on the east side to the eastward, thereby increasing the capacity of the harbor. There appears to be no objection to this, except the opposition of certain riparian owners. The Board would therefore recommend that the line of 1886 be adopted as a pierhead and bulkhead line, with the following changes, viz:

On the east side: The line extending southward from the foot of Howe street to be prolonged in a straight line to meet the causeway of the Lower Bridge; thence to follow westward, southward, and eastward along the outside of said causeway to a point on the south side of the causeway 200 feet distant from its western end; thence to extend southwardly in a straight line a distance of about 720 feet, meeting the harbor line of 1886 at a point 340 feet north of the Farist Steel Company's wharf; thence to follow the lines of 1886 to Long Island Sound.

On the west side: The line of 1886, extending southwestwardly from the Naugatuck Railroad Wharf, to be prolonged 290 feet; thence to extend southwardly 1,750 feet to a point 230 feet from the east end of the north side of the slip, foot of Henry street; thence to extend east-southeastwardly 390 feet to a point 25 feet distant from the northwest extremity of "the tongue;" thence to extend in a course toward a point 50 feet northwest from the inner beacon, until it meets the harbor line of 1886; thence to follow said harbor line of 1886 to Long Island Sound.

The legal question presented to the Board at the public hearing held by direction of the Secretary of War at Bridgeport, July 14, 1891, involves the line on the east side of the harbor below the lower bridge, including its circumscribing lines and the site of the steel works.

The point raised by the opposition is that the Government can not establish harbor lines on this front, modifying those of 1886, without giving compensation to the riparian owners for all the land under water so taken. The Board would, in this connection remark that all the land in question is covered by water at high tide to a depth of 6 feet and over.

The Board is not competent to express an opinion upon the legal question which has been raised, and therefore submits without comment the inclosed papers marked A, B, C, D, E, F, which bear upon this part of the subject.

There are forwarded herewith two tracings,* one showing the harbor lines recommended and the other (explanatory) showing the changes from the line of 1886, also the following-named documents:*

Petition, April 16, 1891.
Letter of Col. D. C. Houston, June 19, 1891.
Protest, Farist, Joel, *et al.*, marked A (blue).
Copy of opinion in case of Farist Steel Company *vs.* City of Bridgeport. marked B (blue).

*Not printed.

Copy section 38 of the charter of the city of Bridgeport, marked C (blue.)
Brief of remonstrants, marked D (blue).
Brief of petitioners, marked E (blue).
Letter from Morris W. Seymour, Howard H. Knapp, and A. M. Tallmadge, attorneys for remonstrants, marked F (blue).
Petition of John Jandy *et al.*

Respectfully submitted.

D. C. HOUSTON,
Colonel, Corps of Engineers.
G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.
THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
January 6, 1892.

Respectfully submitted to the Secretary of War.

It having been made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of the harbor at Bridgeport, Conn., a board of engineers was constituted by special orders from Headquarters Corps of Engineers, to consider and report upon this subject; and the report of the board recommends for approval of the Secretary of War the harbor and dock lines described in the within report and delineated upon the accompanying chart.

A protest having been made against the establishment of harbor lines in this locality by the Secretary of War, and particularly against the establishment of any line other than the one already established by the city of Bridgeport, the Secretary of War authorized that a hearing be given the protesting parties, which hearing was held July 14, 1891, before the board of engineers constituted to report upon the subject of the harbor lines in question. The board reports itself as not competent to express an opinion upon the legal question which has been raised, and therefore submits without comment the inclosed papers marked A–F, which bear upon this part of the subject.

It is recommended that the lines selected by the board be approved, and that the Secretary place his approval both upon the report and the tracing submitted, which shows these harbor lines.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., February 26, 1892.

Respectfully returned to the Secretary of War, with report of this office inclosed.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Third indorsement.]

WAR DEPARTMENT, *March 9, 1892.*

Respectfully returned to the Chief of Engineers, inviting attention to the inclosed report of the Acting Judge-Advocate-General.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 11, 1892.

Respectfully returned to the Secretary of War.

The opinion of the Acting Judge-Advocate-General, dated the 25th ultimo, has been carefully noted.

The recommendation in first indorsement that the harbor lines proposed by the board be approved is renewed.

H. M. ADAMS,
Major, Corps of Engineers, in charge.

[Fifth indorsement.]

WAR DEPARTMENT, *March 3, 1893.*

In view of the report of the Acting Judge-Advocate-General, no action will be taken in the matter of the establishment of harbor lines at Bridgeport, Conn.

S. B. ELKINS,
Secretary of War.

[Sixth indorsement.]

WAR DEPARTMENT, *July 1, 1893.*

Respectfully returned to the Chief of Engineers.

Inasmuch as no action has been taken in the matter of the establishment of harbor lines at Bridgeport, Conn., and inasmuch as it is now apparent that some action ought to be taken in the matter, it is decided to approve of the harbor lines recommended by the board appointed to examine into and consider the matter, which board consisted of Col. Houston, Lieut. Col. Gillespie, and Capt. Casey, all of the Corps of Engineers, and whose report thereon is dated January 4, 1892. And the harbor line at Bridgeport, Conn., is approved and established as recommended by said board and by the Chief of Engineers.

L. A. GRANT,
Acting Secretary of War.

APPENDIX E.

IMPROVEMENT OF HUDSON RIVER AND NEW YORK HARBOR AND OF RIVERS AND HARBORS IN THEIR VICINITY, NEW YORK AND NEW JERSEY.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Hudson River, New York.
2. Harbor at Saugerties, N. Y.
3. Harbor at Rondout, N. Y.
4. Wappinger Creek, New York.
5. Harlem River, New York.
6. East River and Hell Gate, New York.
7. Newtown Creek, New York.
8. Buttermilk Channel, New York Harbor.
9. Gowanus Bay, New York.
10. New York Harbor, New York.
11. Jamaica Bay, New York.
12. Raritan Bay, New Jersey.
13. Removing sunken vessels or craft obstructing or endangering navigation.

EXAMINATIONS.

14. Fort Pond Bay, New York.
15. Channel west of Robbins Reef Light-House to connect mouth of Arthur Kill with New York Harbor.

HARBOR LINES.

16. New York Harbor and adjacent waters.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., July 8, 1893.

GENERAL: I have the honor to transmit herewith annual reports for the fiscal year ending June 30, 1893, upon the works of river and harbor improvement under my charge.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

The Annual Report of the Chief of Engineers for 1885, Part I, p. 677, contains a history of this improvement accompanied by original reports and two sketches showing its condition at that time.

The only part of the Hudson River which has been improved by the General Government is a stretch about 20 miles long, beginning at the head of navigation at Troy, N. Y., about 6 miles above Albany, and extending down the river to New Baltimore, about 14 miles below Albany.

While there has always been enough water below New Baltimore for navigation, this upper section of the river, so far as its history is known to us, has always been obstructed by bars and shoals, due to the existence of numerous islands and sloughs and the consequent diversion of the river's waters through too many channels.

Prior to 1831, when the jurisdiction of the Federal Government over these waters was confirmed by judicial decision, the State of New York had made efforts to improve the navigation of this part of the river.

Since 1831 the improvement of the Hudson River has been conducted both by the State of New York and by the General Government, both building and repairing dikes and doing such dredging as seemed necessary. In the last few years, however, the dike work has been left almost exclusively to the General Government and the dredging to the State of New York.

The general system of improvement has been the same throughout, the contraction of the channels by the construction of jetties and dikes intended to deepen them by means of the scour so produced, and also the lowering of the bed by dredging where such work was indispensable.

But up to 1831 the work, which had consisted almost entirely of the construction of spur dikes and dredging, had produced very little permanent improvement.

After 1831, however, the United States began the present general system of improvement, which consists of contracting the channel by means of longitudinal dikes intended to aid in scouring the bars and shoals, instead of which spur jetties had formerly been used.

Under this system the United States constructed two dikes in 1835, 1836, 1837, and 1838.

Then followed a long interval of time in which nothing was done by the United States except in 1852; but in 1863 the State of New York took up the improvement on the general plan adopted by the United States in 1831, viz, substituting a system of longitudinal dikes instead of the jetty system, and between 1863 and 1867, built six important longitudinal dikes of this kind. (Annual Report of 1885, p. 678.)

The work was again taken up by the United States in 1864, when, out of the general sum appropriated for river and harbor improvements, $33,000 was allotted for the Hudson River improvement, and this was followed by the act of June 13, 1866, which appropriated $50,000 for the same work.

The plan of improvement adopted in 1867 provided for securing a navigable channel 11 feet deep at mean low water from New Baltimore up to Albany and 9 feet deep at mean low water from Albany up to Troy.

The following is a description of the plan:

First. A system of longitudinal dikes to confine the current suffi-

ciently to allow the ebb and flow of the tidal current to keep the channel clear. These dikes to be gradually brought nearer together from New Baltimore towards Troy, so as to assist the entrance of the flood current and increase its height, their height to be kept approximately at the level of the tidal high water, so as not to confine the freshets; the exact level, however, being left to be determined by experience as the work progresses.

Second. That the dredge be used so far as necessary to open the channels above described, which the current should not be allowed to do, except very gradually, lest accumulations dangerous to navigation be formed below.

Third. Keeping, as far as practicable, the side reservoirs open to the passage of tidal currents by gaps at their lower extremities, in order to increase the tidal flow.

Fourth. Dumping all dredged material in secure places, where it can not be moved back again into the channel by the current.

Fifth. Constructing the dikes of timber and stone, in a manner to secure their permanency, at a minimum cost, the details, varying with the locality, to be left to the discretion of the local engineer, to be so designed as to admit of having an increased height given to the dikes, if necessary.

Sixth. To protect, when necessary, the banks and islands against the abrading action of the currents by revetments.

Seventh. That limits, beyond which no encroachments upon the channel should be made, be prescribed, and that any such encroachments be reported to the engineer in charge.

The cost of the improvement, according to the estimate of 1867, was $1,000,000, but the amount which had been actually spent upon the project up to June 30, 1892, the date of its practical completion, was $1,247,940.29.

From the nature of the materials which enter into the construction of the dikes and from the limited sums which are applied annually to renew the parts which become unserviceable, whether by natural decay or otherwise, it can be well understood that the estimates prepared from time to time for the completion of the project must be accepted as approximately accurate for only a short period of time. This statement is necessary for a correct understanding of the apparent discrepancy between the estimated and the actual cost of the project.

A new project was adopted in 1891, which provided for maintaining old improvements and constructing new regulating works along 8 additional miles of the river below New Baltimore, and also for deepening the entire reach of the river under improvement, so as to afford a channel 400 feet wide and 12 feet deep at mean low water, from Coxsackie to the foot of Broadway, Troy, N. Y., and thence 300 feet wide and 12 feet deep to the State Dam.

The estimated cost of the project is $2,500,000, provided the entire work be completed within five years.

The sanction of Congress to the project was given by the river and harbor act approved July 13, 1892, with the proviso that contracts might be entered into by the Secretary of War for such materials and work as might be necessary to carry out the plan, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate the sum of $2,447,906.

The State of New York makes an appropriation at every session of its legislature for the improvement of the Hudson River, and prior to

1867 the money was applied to the construction of dikes on the left bank of the river from Houghtailing Island to Albany, to jetties, dams, and to temporary measures of relief, and also to dredging at the points where shoals were discovered after spring freshets. In the last few years, however, the dike work has been left almost exclusively to the General Government and the dredging to the State.

Sections 6 and 7 of the river and harbor act of September 19, 1890, make it unlawful to dump into the navigable waters of the United States any materials which shall tend to impede or obstruct navigation, or to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of said navigable waters, unless approved and authorized by the Secretary of War. These are wise provisions for the protection of the navigable waters of the United States, and it is hoped that a considerate enforcement of the law will serve hereafter to protect the channel of the river by maintaining its regimen, and at the same time to allow material to be taken freely from the river for private and public uses.

Section 3 of the river and harbor act of July 13, 1892, amendatory of section 7 of the act of 1890, referring to structures which may be authorized in navigable waters, is so important that a copy is here inserted for the information of the public:

That it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty, or structure of any kind outside established harbor lines, or in any navigable waters of the United States where no harbor lines are or may be established, without the permission of the Secretary of War, in any port, roadstead, haven, harbor, navigable river, or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce, or anchorage of said waters; and it shall not be lawful hereafter to commence the construction of any bridge, bridge draw, bridge piers and abutments, causeway, or other works over or in any port, road, roadstead, haven, harbor, navigable river, or navigable waters of the United States, under any act of the legislative assembly of any State, until the location and plan of such bridge or other works have been submitted to and approved by the Secretary of War, or to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of any port, roadstead, haven, harbor, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States unless approved and authorized by the Secretary of War.

Provided, That this section shall not apply to any bridge, bridge draw, bridge piers and abutments the construction of which has been heretofore duly authorized by law, or be so construed as to authorize the construction of any bridge, drawbridge, bridge piers and abutments or other works under an act of the legislature of any State, over or in any stream, port, roadstead, haven, or harbor or other navigable water not wholly within the limits of such State.

The average rainfall covering the past sixty-three years, from observations recorded in the report of the water commissioner of Troy, N. Y., for 1889, is 36.55 inches. The greatest rainfall in any year was recorded in 1878, when 49.23 inches fell; the least rainfall in any year occurred in 1839, when 18.32 inches fell. The greatest known rainfall in any one month occurred in October, 1869, when 13.8 inches fell; the least known rainfall in any one month was in May, 1840, when only 0.2 of an inch fell.

At times during the dry season of most every year, for a month at least, no water flows over the State Dam at Troy, and excepting what comes in through the lockage of the canals there is, during that period, little apparent fresh-water supply to the flow of the river. From this and the fact that the tide rises and falls at the State Dam, it is evident that the navigation of the Hudson River at the low stage is dependent in a large degree upon the tidal prism of the river.

The mean rise and fall of tides—

	Feet.
At State Dam, Troy, N. Y., is	0.80
At Nail Works, Troy, N. Y., is	1.92
At Albany, N. Y., is	2.32
At Castleton, N. Y., is	2.53
At Baltimore, N. Y., is	3.42
At New York, Governors Island, from Coast Survey	4.40

The mean duration of rise of tide at Albany is 5 hours 0 minutes, and the mean duration of fall, 7 hours 25 minutes.

The plane of mean low water at New York is below that—

	Feet.
At New Baltimore	3.55
At Castleton	4.35
At Albany	4.78
At Troy Nail Works	5.32
At Troy State Dam	6.88

The plane of mean high water at New York is below that—

	Feet.
At New Baltimore	2.57
At Castleton	2.48
At Albany	2.70
At Troy Nail Works	2.84
At State Dam, Troy	3.28

The heights of the greatest known freshets above the plane of mean low water at Albany are as follows:

That of February 9, 1857, due to an ice gorge at Van Wies Point, was 22.19 feet.

That of October, 1869, due to the great rainfall in that month, which reached 13.8 inches, was 19.04 feet.

That of February, 1886, due to an ice gorge, was 17.89 feet.

Generally speaking, the effects of rainstorms are shown by a rise in the river within twenty-four hours. The winds also materially affect the height of the water; south and east winds drive the water up the river, causing very high tides, while a north or west wind produces an opposite effect.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the beginning of the fiscal year July 1, 1892, the following contract and agreement were in force: Contract with William Fuller, dated January 13, 1891, expiring December 31, 1891, extended to December 1, 1892, for the construction of certain new dikes and the repairing of certain existing dikes in the Hudson River between Troy and New Baltimore; and open-market agreement with William Parrott, dated October 15, 1891, for hire of pile-driver and men, furnishing material to make repairs to Bath, Bogart Island, and Beacon Island Dikes, and putting up timber frame work for ranges at Overslaugh Rock.

Besides the above, the following contracts and open-market agreements were made during the fiscal year:

Open-market agreement with P. W. Myers, dated August 25, 1892, for dredging and removing broken stone from the Overslaugh Rock.

Open-market agreement with William Fuller & Sons, dated August 29, 1892, for putting up timber framework for ranges at Overslaugh Rock.

Open-market agreement with J. P. Randerson, dated September 13, 1892, for removing wreck at Troy, near Citizens Line Dock.

Open-market agreement with William Fuller & Sons for furnishing additional stone for dikes, dated October 13, 1892.

Open-market agreement with William Fuller & Sons, dated April 1, 1893, for driving guide piles to define the dikes submerged during freshet times.

Open-market agreement with P. W. Myers, dated April 10, 1893, for removing wreck of canal boat at Mulls Cross Over.

The river and harbor act approved July 13, 1892, appropriated $187,500 for improving Hudson River, New York, by extension of project of improvement adopted in 1867 so as to provide for a channel 12 feet deep and 400 feet wide from Coxsackie to the foot of Broadway, Troy, and thence 12 feet deep and 300 feet wide to the State dam at Troy, N. Y., provided that contracts may be entered into by the Secretary of War for such materials and work as may be necessary to carry out the plan recommended by the Board of Engineers, U. S. Army, dated October 1, 1891, and printed in House Ex. Doc. No. 23, Fifty-second Congress, first session, for the improvement of the Hudson River as above stated, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $2,260,406, exclusive of the amount herein and heretofore appropriated.

Sealed proposals were invited according to law, and contracts were made with the lowest bidders for the completion of the project recommended by the Board of Engineers October 1, 1891.

The contract with P. Sanford Ross, dated December 19, 1892, provided for the removal of 190,000 tons of rock and 30,000 tons of sand covering rock in place; and the contract with Edwards, Howlett & Thompson, dated December 23, 1892, provided for the construction and repair of 40,000 linear feet of dikes and the dredging of 4,620,000 cubic yards of material.

The amount of the appropriation allotted to Mr. Ross was $25,000, and to Messrs. Edwards, Howlett & Thompson was $130,000. The work represented by these allotments was required to be completed October 1, 1893.

The "act making appropriation for sundry civil expenses of the Government for the fiscal year ending June 30, 1894, and for other purposes," approved March 3, 1893, appropriated $500,000 for continuing the improvement of the Hudson River, provided that not more than three-fourths of the appropriation should be expended during the fiscal year ending June 30, 1894. Of this sum $90,000 were allotted to Mr. Ross, contractor for removal of rock, and $384,000 to Messrs. Edwards, Howlett & Thompson, contractors for dike work and dredging, three-fourths of the work in each case to be completed by July 1, 1894, and the residue by December 31, 1894.

The work under contract with Wm. Fuller & Sons was pushed to completion December 1, 1892. The work under all the open-market agreements was also completed, and the contracts with P. Sanford Ross and Edwards, Howlett & Thompson alone remain in force at this date.

The progress made during the fiscal year ending June 30, 1893, under the above contracts and open-market agreements may be summarized as follows:

CONSTRUCTION OF NEW DIKES.

Mulls Dike Extension to Shad Island.—Under contract with Wm. Fuller & Sons; the construction of this dike was in progress and nearly completed at the beginning of the fiscal year, and was fully completed

August 20, 1892. It extends from the north end of the stone dike at Mulls to Shad Island, a distance of 2,535 feet. It is a double-pile dike 12 feet wide filled with stone and chinked in with quarry spalls, the top of the dike being 1.6 feet above mean low water. A layer of large stone is placed on the top of the filling on a level with the top of the timberwork and carefully chinked in. One thousand two hundred and eighty-six cubic yards of stone were furnished and put in place. This structure cost $12 per running foot.

Coxsackie Island Dike.—Under contract with Messrs. Edwards, Howlett & Thompson; this dike is in course of construction, the work having been begun June 22, 1893. It is designed for a shore protection, to prevent erosion, and is of the plan of a half dike extending along the shore for about 1,700 feet around the upper end of the island.

Piles covering 829 feet of this dike have been driven and sawed off, using 24,748 linear feet of pine piles.

REPAIRS TO EXISTING DIKES.

West Dike, New Baltimore.—Under contract with Wm. Fuller & Sons; this dike was thoroughly repaired. A new timber structure was built over a length of 425 feet at the upper end. Piles were driven on face and rear, 5 feet apart from center to center, connected by two courses of 8 by 12 inch waling timber, and the front tied to the rear with tierods every 5 feet, and the structure then filled with stone. The middle section, 1,505 feet long, was refilled with stone where the original filling had settled, and 460 feet at the south end were repaired by driving piles, front and rear, every 5 feet, connected together by a double course of 8 by 12 inch waling timber and tied front and rear by iron tierods every 5 feet. The structure was then filled with stone.

Mulls Island Dike.—Under contract with Wm. Fuller & Sons; this dike was thoroughly repaired throughout its whole length of 4,000 feet. Two breaks in the dike, aggregating 150 feet, were rebuilt in the manner of the original dike, which was a half-dike construction. Waling timbers, where loose or destroyed, were replaced by 6 by 12 inch square timber, and the whole dike filled with stone where settlement had taken place.

Campbells Island Dike.—Under contract with Wm. Fuller & Sons; most of the repairs to this dike had been made during the last fiscal year. They were completed in full September 19, 1892. The single-pile extension for 1,350 feet was repaired by driving piles where necessary and connecting them together by a single course of 4 by 12 inch waling timber put on either side and fastened together by screw bolts through each pile.

Beacon Island Dike (a half-dike shore protection).—Timber repairs made under agreement with Wm. Parrott, stone filling put in under agreement with Wm. Fuller & Sons. The waling timbers of the old dike were entirely gone and a number of piles broken out. The dike was thoroughly repaired, new piles driven where necessary, new waling timbers put in, and the dike filled with stone covering a length of 550 feet.

Bogart Island Dike (a half-dike shore protection).—Timber repairs made under agreement with Wm. Parrott, stone filling put in under agreement with Wm. Fuller & Sons. Most of the original dike had been carried away and destroyed. New piles were driven where necessary, new waling timbers put on, and dike filled with stone. The breech just north of Bogart Island Light, between Cabbage and Bogart

Island, was closed, excepting a small opening 20 feet wide, which was left for the convenience of the adjacent ice houses.

Bath Dike.—Timber repairs made under open-market agreement with William Parrott, stone filling put in under agreement with William Fuller & Sons. The break in the dike, 50 feet wide, was closed by a timber structure similar in plan to that of the original. The structure was then filled with stone.

Patroons Lower Island Dike.—Under contract with William Fuller & Sons 300 feet of this dike was reconstructed by building a crib over the old dike, which was then revetted on the inside with stone and filled with dredged material. The dike was then paved by hired labor. The structure was made 30 feet wide with a crown of 3 feet. Top of dike is 6 feet above mean low water.

Pleasure Island Dike.—Material furnished under agreement with William Fuller & Sons; work, paving revetment, done by hired labor. The shore of this island for a length of 2,200 feet was thoroughly protected by a stone revetment held in place by a timber skewback.

This constitutes all the repairs to dikes during the fiscal year. The following material was used:

13,818 linear feet pine piling.
7,374 linear feet round timber.
89,827 B. M. feet square timber.
19,296 pounds tie-rods and screw bolts.
10,665 pounds drift-bolts and spikes.
4,978 cubic yards ordinary rubblestone.
1,219 cubic yards paving stone.
600 cubic yards dredged material.

DREDGING.

There was very little dredging done during the summer and fall of 1892. Under agreement with P. W. Myers, dated August 25, 1892, 1,280 cubic yards of broken rock and 440 cubic yards of sand were dredged and removed from the site of the Overslaugh Rock after operations of drilling and blasting by the drill scow had been completed.

Under contract with Edwards, Howlett & Thompson work was started dredging at Austins Rock and Mulls Cross-Over May 15, 1893. The dredging at Austins Rock, for the purpose of uncovering the rock before the operations of rock removal began, was completed after 1,407 cubic yards were removed.

The work at Mulls Cross-Over is now in progress with two dredges at work. On account of the difficulty in disposing of dredged material it has been impossible to push this class of work. The contractor is preparing a dump ground back of the New Baltimore Dike where with present facilities only a limited quantity of material can be hauled and dumped. The contractor expects later to dispose of a large quantity by employing a suction dredge that will deliver the material over the dike and some distance beyond it. He has now in course of construction a suction dredge that is promised to handle 4,000 cubic yards per day. The amount of material dredged and removed during the fiscal year equals 51,331 cubic yards.

WRECKS.

During the fiscal year three wrecks were removed from the river. One, the wreck of the canal boat *C. P. Grant*, from channel near foot of Broadway, Troy, and one, the wreck of a burned canal boat from the

river near Forbes Dock, under agreement with J. P. Randerson, dated September 13, 1892; also, under open-market agreement with P. W. Myers, dated April 10, 1893, the wreck of an old canal boat was removed from channel at Mulls Cross-Over.

REMOVAL OF ROCK.

The work removing the rock from the channel north of Van Wies Point known as Overslaugh Rock, which was in progress at the end of the last fiscal year, was fully completed September 17, 1892. This work was done by hired labor and the use of the United States drill scow *Hudson*. A force of 13 men, including a foreman and diver, was employed. Holes were drilled from the deck of the scow by steam drills, and then charged with forcite cartridges which were electrically exploded. The broken rock was dredged up by a dipper dredge, and a depth of 12 feet at mean low water was secured over the site of original reef.

During the fiscal year 754 holes were drilled, which had a measurement of 3,365 linear feet; 4,086 square feet were blasted over; and 3,511 pounds of forcite were exploded.

The holes were drilled 2 to 3 feet below the required depth so as to insure the absolute depth of 12 feet on removal of fragments.

Total number of cubic yards removed	1,440
At a cost of	$12,802.62
Total number of cubic yards in place	865

Or at $14.80 per cubic yard in place.

The excessive cost of removal is due to constant delays and to frequent suspensions of work arising from freshets, and to the incessant movement of sand over the rock, which interrupted the drilling.

After the removal of the Overslaugh Rock the drill scow was removed to Breakers Island, near Troy, and work started September 20, 1892, blasting and removing rock from a long reef extending from the east shore at this point northwest to near the center of the channel. This work was continued until November 30, 1892, when operations ceased on account of the cold weather. At that date 427 holes had been drilled measuring 2,755 linear feet; 6,816 square feet of surface had been blasted over, and 1,738 pounds of forcite used. The area was then dredged over and 900 cubic yards of broken rock and gravel removed. The work done was located on the north end of the reef.

On the 23d of May, 1893, under contract with P. Sanford Ross, work was commenced removing Austins Rock. The following is a description of the method employed:

The machine is a pile-driver scow, 60 by 22.9 feet, with guide frame 65 feet high, but instead of the single pile-driver hammer there are two wrought-iron chisels, 8 by 12 inches by 36½ feet, swung between the guides. The chisels, which weigh 6 tons apiece, have cutting edges of steel, the steel consisting of a bar 3 by 12 inches by 5 feet, set into one end of the wrought-iron bar. The cutting edges of the two drills are placed at right angles to each other in the guides.

On the scow are placed one large boiler with a double-drum hoisting engine for raising the chisels, and on the rear an auxiliary engine with two drums for working the cables attached to the anchors and for raising the spud. The scow used was found too small for the load after all of the machinery was placed on it, and was reënforced by two pontoons, each 8 feet 6 inches wide by 41 feet 9 inches long.

The scow is anchored and swung by the following arrangement: Two wire-rope cables, attached to drums placed on the rear of the

scow, run forward to shears on each side of the guides, and thence to anchors dropped at the proper distances to right and left of the rock to be removed. These cables are kept very taut and used for swinging to right or left over the reef as much or as little as circumstances require. On the rear of the scow there are two iron spuds placed 3 feet 6 inches apart from center to center and at different distances from the center line of the scow. When at work the spud nearest the center line of the scow is down and the chisels are swung on the arc of a circle, this spud being the center, by means of the wire-rope cables attached to the anchors above described, until the desired range is covered. When this is done, the second spud is dropped and the first one raised, and the scow swung back with this second spud as a center until the chisel points are, say, 1 or 2 feet, as required, inside the first-described arc, when the first spud is dropped and the second one raised, and the chisels then are worked over the arc of the circle with the new center. By this the chisels cover an arc concentric with the first arc and 1 or 2 feet from it, as arranged for.

The limits of the swing of the machine are defined by means of a boat compass on the scow, or by shore ranges, and can also be approximately determined by graduation on the wire-rope cables attached to the anchors.

The following table gives the number of degrees of arc which should be swung on the second spud before lowering the first for parallel cuts of different widths:

Width.	Arc.	Length of arc.
Feet.	° ′	*Feet.*
1	14 56	15.37
2	21 08	21.76
3	25 54	26.70
4	29 55	30.81

The chisels are dropped about 15 feet, and can be raised and dropped at the rate of twelve blows per minute, but the experience so far shows a rate of about six blows per minute to be the most economical. At the above rate the penetration of the chisels is as follows:

Rock penetrated.	No. of blows.	Time consumed.
		Minutes.
First foot	18	3
Second foot	27	4½
Third foot	36	6

The work done, as far as could be determined by a boring rod, seemed most thorough.

A clam-shell dredge, with steel teeth, is now at work dredging up the broken rock. With the exception of two large bowlders, measuring about 2 cubic yards each, the rock comes up in pieces from the size of a hen's egg to the size of a man's head, which is good evidence of the effective working of the chisels.

The amounts of material, sand covering, and rock removed are determined by actual measurement in place from soundings, checked by measurements by water displacement.

At the close of the fiscal year there had been removed from Austin's Rock—

	Tons.
Rock	109
Sand covering	14

HIRED LABOR.

Beside the hired labor employed on the drill scow, a foreman and fifteen men were employed, during the summer and fall of 1892, repairing the Pleasure Island and Patroons Lower Island dikes, and rearranging the stone in all the dikes between Troy and New Baltimore where it had been disturbed by ice and river currents.

Three hundred feet of Patroons Lower Island Dike was reconstructed and the paving relaid, and the stone revetment along the shore of Pleasure Island for a distance of 1,700 feet was thoroughly repaired and repaved.

HYDROGRAPHIC AND OFFICE WORK.

The work on the model of the Hudson River, which was in progress at the end of the last fiscal year, was fully completed and a cast made for the World's Columbian Exposition at Chicago.

Surveys were made of the rock at Breakers Island, Overslaugh, rock at Arsenal Dock, shores of Breakers Island, Willow Island Shoal, and rock borings taken from State Dam south. The notes of all these were worked up and platted.

During the winter the force was reduced to the assistant and two men. Notes were completed and tracings and specifications for the work of the following season were prepared.

During the spring months a survey of Austins and Van Wies Rock; also of the shoal bars at New Baltimore, Mulls, Nine Mile Tree, and Cedar Hill were made.

GENERAL REMARKS.

During the season of navigation of 1892 the navigable channel was in better condition than ever before. The complete removal of the Overslaugh rock was a very material benefit. The ice gorges in the winter and spring, however, created disturbances which were really serious. Ice of unusual thickness was formed during the winter and, when at the opening of spring it began to break up and move down the river, a jam packed solid to the bottom was formed between Cedar Hill and North Coeymans. The water in the upper river was in consequence so raised that at Albany it stood, March 14, 1893, 19 feet above the plane of mean low water. When the river became free, examinations were made all along the river, which revealed that deep holes had been scoured in the bed at many points, and that shoals had been formed at Cedar Hill, Nine Mile Tree, and Mulls Cross-Over, and in the East Channel, New Baltimore, reducing depths at these points to less than 8 feet, mean low water. Every effort is being made to give relief, but the work is very slow and much circumscribed by the difficulty of disposing of the dredged material. The contractors are building special plant, suction and dipper dredges, but owing to delays have not as yet been able to get under full headway. The several recommendations in last year's report have been considered in the approved project for the expenditure of the appropriations made by acts of Congress July 13, 1892, and March 3, 1893, and the construction of the permanent works reported to be necessary to complete the improvement as originally

projected are covered by different allotments from available balances and are included in existing contracts.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $65,448.22.

The amount that can be profitably expended during the fiscal year ending June 30, 1895, is $500,000.

This improvement has been under the local charge of Mr. Charles G. Weir, assistant engineer, who has well and faithfully discharged the duties assigned to him.

This work is in the collection district of New York, Albany being a port of entry.

AMOUNTS APPROPRIATED.

Act June 30, 1834	$70,000.00
Act July 2, 1836	100,000.00
Act March 3, 1837	100,000.00
Act July 7, 1838	100,000.00
Act August 30, 1852	50,000.00
	420,000.00

AMOUNTS APPROPRIATED FOR PRESENT PROJECT.

Act June 26, 1864, allotment	$33,000.00
Act June 23, 1866	50,000.00
Act March 3, 1867	305,188.00
Act July 25, 1868	85,000.00
Act April 10, 1869	89,100.00
Act July 11, 1870	40,000.00
Act March 3, 1871	40,000.00
Act June 10, 1872	40,000.00
Act March 3, 1873	40,000.00
Act June 23, 1874	40,000.00
Act March 3, 1875	40,000.00
Act August 14, 1876	50,000.00
Act June 18, 1878	70,000.00
Act March 3, 1879	30,000.00
Act June 14, 1880	20,000.00
Act March 3, 1881	15,000.00
Act August 2, 1882	10,000.00
Act July 5, 1884	30,000.00
Act August 5, 1886	26,250.00
Act August 11, 1888	75,000.00
Act September 19, 1890	150,000.00
Act July 13, 1892	187,500.00
Act March 3, 1893	500,000.00
Total	1,966,038.00
Received from other sources	792.57
	1,966,830.57
Amount expended to June 30, 1893, inclusive of outstanding liabilities	1,303,665.06

Money statement.

July 1, 1892, balance unexpended		$41,113.73
Amount appropriated by act approved July 13, 1892		187,500.00
Amount appropriated by sundry civil act approved March 3, 1893		500,000.00
		728,613.73
June 30, 1893, amount expended during fiscal year		54,411.13
July 1, 1893, balance unexpended		674,202.60
July 1, 1893, outstanding liabilities	$11,037.09	
July 1, 1893, amount covered by uncompleted contracts	620,736.13	
		631,773.22
July 1, 1893, balance available		42,429.38

Amount (estimated) required for completion of existing project$1,760,406.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Hudson River, New York, received in response to advertisement dated August 24, 1892, and opened September 29, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

Materials, etc.	1. Peter W. Myers.		2. William Fuller & Son.		3. Edwards, Howlett & Thompson.		4. P. Sanford Ross.	
	Per unit.	Amount.	Per unit.	Amount.	Per unit.	Amount.	Per unit.	Amount.
Constructing and repairing dikes, Upper Hudson River (new work estimated at 40,000 linear feet).								
Pine or spruce piles (900,000 linear feet).....lin. ft.			$0.14	$126,000	$0.10⅞	$97,875.00	$0.16 5/10	$148,500
Round timber (70,000 linear feet).....lin. ft.			.10	7,000	.10⅞	7,612.50	.14½	10,150
Square timber, yellow pine (700,000 B. M. feet).....M. ft. B. M.			42.00	29,400	36.75	25,725.00	40.00	28,000
Tie rods and screw bolts (400,000 pounds).....pound			.06	24,000	.03⅞	15,500.00	.04½	18,000
Drift bolts, spikes, and washers (100,000 pounds).....pound			.05	5,000	.03⅞	3,875.00	.04	4,000
Large stone (4,500 cubic yards).....cu. yd.			1.50	6,750	1.27	5,716.00	1.05	4,725
Ordinary rubble stone (40,000 cubic yards).....cu. yd.			1.10	44,000	.97	38,800.00	1.00	40,000
Small rubble stone (10,000 cubic yards).....cu. yd.			1.10	11,000	.87	9,700.00	1.15	11,500
Paving stone (20,000 cubic yards).....cu. yd.			1.40	28,000	1.07	21,400.00	1.60	32,000
Dredging and placing 30,000 cubic yards of material.....cu. yd.			.30	9,000	.17	5,100.00	.50	15,000
Total amount of dike work				290,150		231,302.50		311,875
Rock removal.								
Drilling, blasting, and removing 190,000 tons of rock (1 cubic yard estimated to contain 2 tons, approximately).....ton of 2,000 pounds					6.37	1,210,300.00	5.00	950,000
Excavating and removing 30,000 tons sand covering.....ton of 2,000 pounds					.19 7/10	5,910.00	.50	15,000
Total amount for rock removal						1,216,210.09		965,000
Dredging.								
Excavating and removing 4,620,000 cubic yards of material..cu. yd.	$0.16	$25,000			.20 7/10	956,340.00	.33 A/10	1,543,080
Grand total		*25,000		†290,150		‡2,403,852.50		§2,819,955

* Bid limited regarding quantity and location of work.
† Bid for dike work only.
‡ Lowest bid for dike work and for dredging.
§ Lowest bid for rock removal.

COMMERCIAL STATISTICS.

The information contained in the report made in 1890 on the commercial statistics of the Hudson River, by Mr. Charles G. Weir, assistant engineer, was so complete that it is deemed best to repeat it in the report for this year.

The importance of the Hudson as a great waterway of commerce is apparent when it is known that aside from its own local traffic, which in itself is very large, it ab-

sorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburg, and the Erie coal trade at Piermont. The average season of navigation of the river is 240 days and that of the canals 220 days.

The Erie Canal, extending from Albany to Buffalo, on Lake Erie, a distance of 352 miles, with a difference of level of 577 feet, and to Oswego, on Lake Ontario, connects the Great Northern Lakes with the Hudson River, and brings in immense commerce from the Northwest and Canada. The principal items of this commerce are lumber and grain.

The Champlain Canal, 60 miles long, connects Lake Champlain with the Hudson River. This lake, which is 93 feet above tide of the Hudson, and whose waters flow into the St. Lawrence, is connected by the Chambly Canal with the St. Lawrence River below Montreal. The principal items of tonnage on this canal are lumber and iron ore. The above canals, with 575 miles of subsidiaries, constitute the New York State canals. The Erie Canal enters the Hudson by three tide-water locks, one at the foot of Twenty-third street, West Troy; one at the foot of Eighth street, West Troy, and a third at the lumber district, Albany.

The Champlain Canal enters the river at Waterford, 3 miles above the State Dam, and boats are locked through the dam to tide water. It is also connected with the Erie Canal and, through its tide-water locks, with the Hudson River.

The Delaware and Hudson Canal enters the Hudson through Rondout Creek at Rondout, N. Y., and brings the anthracite coal country at Honesdale and the Delaware River into water communication with the Hudson. The principal items of tonnage on this canal are coal, bluestone, and cement. Aside from the above feeders to the commerce of the Hudson, the Pennsylvania Coal Company has a large tide-water coal depot at Newburg, where also the Erie Railroad has a terminal point and transfers large quantities of freight by boat across the river. The Erie Railroad also has a coal depot at Piermont, 20 miles above New York, where preparations are being made to handle a very large supply.

The following statistics include the tonnage received at all points above Spuyten Duyvil Creek, and of the local shipment between points on the river; only that shipped is credited to the points from which it was shipped, no entry being made to the total tonnage of the amount received at local points from other local points. The total tonnage also includes all through freight shipped from points up the river that passed the mouth of Spuyten Duyvil Creek going south.

The two principal industries on the river which add materially to the local tonnage are ice and brick. The capacity of the ice houses on and adjacent to the river exceeds 4,000,000 tons, and amount generally harvested 3,500,000. The brick manufactured on the river exceed 850,000,000.

Total tonnage of all shipping points on the Hudson River during 1889, not including the tonnage coming through State canals	tons..	15,033,309
Value of same		$378,196,094
Total tonnage coming to and leaving tide water through State canals, 1889	tons..	3,592,437
Value of same		$108,000,000
Increase of same over tonnage, 1888	tons..	326,466
Grand total tonnage of the Hudson River, including the tonnage through State canals	tons..	18,582,596
Value of same		$485,733,094

This does not include the value of vessels carrying the above trade, which are equally exposed to the dangers of navigation.

Number of transportation companies for passengers or freight, not including steamboats or pleasure boats	30
Total number of passengers carried, 1889	5,000,000
Total population along the river	450,000

Commercial statistics of the port of Albany, N. Y., from July 1, 1892, to July 1, 1893.

Amount of revenue collected	$307,259.96
Value of all imports	876,701.00

	Number.	Registered tonnage.
Foreign vessels entered		
Foreign vessels cleared		
American vessels from foreign ports	258	25,561
Coastwise vessels entered		
Coastwise vessels cleared		

Statement of the number and tonnage of all vessels belonging to the port of Albany, N. Y., June 1, 1893.

	Number.	Registered tonnage.
Steam vessels	171	28,998.66
Sailing vessels	32	1,849.69
Barges	75	15,103.77
Canal boats	208	20,775.34

E 2.

IMPROVEMENT OF HARBOR AT SAUGERTIES, N. Y.

The harbor of Saugerties is at the mouth of Esopus Creek, which empties into the Hudson River on the west shore, about 100 miles above the city of New York. With the exception of some slight works undertaken by the inhabitants, giving no permanent results, nothing had been done towards the improvement of this harbor until it was undertaken by the United States Government in 1887. In 1883 a survey of the harbor was made, under the direction of the engineer officer in charge, which indicated that there was a shoal at the entrance 1,100 feet wide between 6-foot contours, over which the least depth was 3 feet, mean low water. Two plans of improvement were recommended, both providing for the construction of parallel dikes and for dredging the channel between them 7 feet deep, mean low water. (See Annual Report of the Chief of Engineers for 1884, Part I, p. 716.)

The reëxamination of the harbor made in 1887 after the State had done some dredging in the channel, resulted in the submission of a third project, differing from those previously submitted only in the direction to be given to the dikes. The range of tides is 4 feet approximately.

The project of 1887 was approved, and its execution was begun the same year. (See Annual Report of the Chief of Engineers for 1887, Part I, p. 662.)

The estimated cost of construction of north and south dikes, each 2,300 feet long, and for excavating from the channel between them 30,000 cubic yards of material, was $52,000.

The purpose of the dikes is to contract the channel, to promote the scour of the freshets, and to maintain the improved navigable depths during the low stage of summer, which usually lasts for two months approximately.

At the close of the fiscal year ending June 30, 1892, both dikes had been completed; the north dike had then a length of 2,058 feet and the south dike a length of 2,363½ feet, and the waterway between them was 260 feet wide.

The inner harbor, west of the shore ends of dikes, was 2,000 feet long, 150 feet wide, and 14½ to 20 feet deep at mean low water. From the steamboat wharf of inner harbor to the Hudson River the navigable channel had been deepened by dredging, giving a width of 150 feet between 9-foot curves.

As the direct result of improvements which have been made by the Government, vessels drawing 12 feet and upward can reach the factories located on the inner harbor at high tide.

The project is completed, with the exception of the removal of a small group of bowlders on the south side of channel near shore end of jetties, and the appropriation asked is to maintain the improvements in good order.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act of July 13, 1892, appropriated $5,000 to maintain the dikes in repair, and to remove the rocky points near the shore end of the north dike.

During the month of September, 1892, a dredge was employed three days to determine more definitely the character of the rocky formation near the shore end of the dikes. Most of what had previously been supposed to be rock in place was found to be bowlders.

The dikes were thoroughly examined at the same time, and specifications were drawn up for the repair of the timber work of portion of the south dike and for the refilling of both dikes with stone where necessary.

Proposals for repairs were invited according to law, and agreement was made September 19, 1892, with Wm. Parrott, the lowest bidder.

The work was begun October 24, and completed December 1, 1892. This involved the reconstruction of 150 feet of the old structure of the south dike, which had been raised and canted by the ice, also the refilling of the north dike with stone where settlement had taken place. Beside this, four men were employed by hired labor for twenty days rearranging the stone in both dikes.

The material furnished and put in by the contractor was as follows:

3,914 linear feet pine piling.
5,086 B. M. feet square timber.
1,414 pounds tie rods.
1,076 pounds drift bolts.
595 cubic yards rubblestone.

As the work removing the rock was of such a character as not to permit its being let conveniently by contract, it was determined to do this work by hired labor and the use of the drill scow *Hudson*. The machine was put to work May 29, 1893. After removing several bowlders from the channel near the shore end of jetties, work was begun removing a portion of the rocky reef projecting into the channel at Barclays Point, on south side of the inner harbor. This reef is not only a great obstruction to navigation, but is the probable cause of the shoaling of the inner harbor, of which it is the eastern boundary. This work is now in progress.

The channel is now in better condition than ever before, and will be much improved when straightened by dredging and when the northern half of the reef at Barclays Point has been removed. The south dike needs slight repairs.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $2,930.95.

The estimate of $5,000 recommended for the fiscal year ending June 30, 1895, will, if appropriated, complete the project of 1887, and if the improvement is to continue thereafter a new project and estimates will be required.

Saugerties is in the collection district of Albany, N. Y., which is the nearest port of entry. The nearest light-house is at the mouth of Esopus Creek.

AMOUNTS APPROPRIATED.

Act July 5, 1884	$5,000.00
Act August 5, 1886	15,000.00
Act August 11, 1888	12,000.00
Act September 19, 1890	10,000.00
Act July 13, 1892	5,000.00
Total	47,000.90
Amount expended to June 30, 1893, inclusive of outstanding liabilities	44,338.01

Money statement.

July 1, 1892, balance unexpended	$592.94
Amount appropriated by act approved July 13, 1892	5,000.00
	5,592.94
June 30, 1893, amount expended during fiscal year	2,775.72
July 1, 1893, balance unexpended	2,817.22
July 1, 1893, outstanding liabilities	155.23
July 1, 1893, balance available	2,661.99
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The commercial carriers are 5 steamboats for freight and passenger traffic, owned by the Saugerties and New York Steamboat Company, the Saugerties and Albany line, and the Saugerties, Rondout and Hudson line, and 405 sailing and other craft, the former carrying 17,000 passengers annually, and in all aggregating 189,000 tons of freight, valued at $5,484,000, the principal products being general merchandise, bluestone, coal, and lumber.

The population of Saugerties is 5,000.

E 3.

IMPROVEMENT OF HARBOR AT RONDOUT, N. Y.

The harbor of Rondout is at the mouth of Rondout Creek, which empties into the Hudson River on its west side, about 90 miles above the city of New York.

From the entrance to the lock of the Delaware and Hudson Canal, a distance of 3 miles, the creek is a tidal stream, the range of tides being 4 feet, approximately.

Prior to 1871 improvements had been made by private persons and corporations, but no permanent benefit had been derived from them. In 1869 a survey of the harbor was made by the Government with a view to its permanent improvement, and it was then found that the available depth of water in the channel was about 7 feet.

The project of improvement, based upon this survey, provided for the formation and maintenance of a channel 100 feet wide and 14 feet deep at the mouth of the creek to be obtained by means of dredging and diking. Two parallel channel dikes were to be built outward, toward and into the Hudson River, their outer ends curving gently down stream, while a branch dike running upstream along the Hudson from the outer end of the north dike was to protect that dike from destruction by running ice. The estimated cost of the work was as follows:

Building the north dike, 748 yards long	$41,600
Building the branch dike, 640 yards long	34,400
Building the south dike, 1,277 yards long	59,600
Dredging channel 3,000 feet long, 100 feet wide, and 14 feet deep at low water, 48,000 cubic yards at 30 cents	14,400
Contingencies	22,500
Total	172,500

The final length of the north and south dikes was, however, to be determined after observing the effects which they might produce in the removal of the bar as they were gradually extended outward. The work was begun in 1872 and was completed in 1880. It was found by experience that the dikes might be made shorter than originally deemed necessary and the total cost of the work reduced to $90,000, less than two-thirds of the original estimate.

On the completion of the work in 1880 the north dike was 2,200 feet, approximately, with a branch dike running up the Hudson 1,000 feet, approximately, and the south dike was 2,800 feet long, approximately, with a spur to the light-house 330 feet long. The distance between the dikes at the entrance was 350 feet, approximately. As the result of the works of improvement, there was a channel over the bar, from the creek to the Hudson, 50 feet wide, giving 13½ feet mean low water; 100 feet wide, giving 12 feet mean low water, and 200 feet wide, giving 10 feet mean low water. At the outer end of the dikes the distance between the 12-foot curves was over 300 feet.

The north and branch dikes were originally built to the height of mean high water, while the south dike, for 500 feet west of the light-house, was built only to the level of the half-tide. The low part of the south dike was subsequently raised by crib work to mean high water; but even with this increased height the dikes are submerged during storm tides and freshets, and are required to be marked by fender piles to enable vessels to enter the harbor at such times without danger of being wrecked upon the concealed dikes.

The appropriations for this harbor made since the completion of the works in 1880 have been applied exclusively to the repair of the dikes. The improved depths in the channel have been well maintained, but the dikes have greatly deteriorated, partly owing to the ice, partly to the natural decay of the timber, and partly to the undermining of the piles by scour.

The survey of the harbor in September, 1889, indicated a continued improvement of the channel between the dikes, not in the enlargement of the width of the 14-foot channel, but in that of the 9-foot channel, which then had a width of 250 feet.

On the south side of the entrance there has been a slight shoaling, due probably to the removal in 1884 of 150 feet from the outer end of the south pier to meet the wishes of the boatmen, who alleged that their tows required a wider entrance between the piers on that side when coming in with vessels on flood tide. The change in length of the south dike doubtless facilitates entrance at flood tide, but the shoaling of the bar on that side, which is shown by the survey of 1889, makes it probable that the south dike should be increased rather than decreased in length.

The river and harbor act of September 19, 1890, appropriated $5,000 for repairing existing works, which was expended in repairs to north and branch dikes. This work was completed October 28, 1891.

The channel maintains itself in good navigable condition sufficient for the wants of commerce. While the dikes are in good condition of repair they are much exposed to damage by ice in the river and by boats, that frequently run into and break down the timberwork at the intersection of the north and branch dikes.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

The river and harbor act of July 13, 1892, made an appropriation of $5,000 for repairs to existing works.

Proposals for repairing the north and south dikes were invited October 13, 1892, and contract for the work was made with William Parrott, the lowest bidder, October 31, 1892.

The work covered the repairs to the north branch dike, putting on new waling timber where the old timber had been displaced, the rebuilding of 350 feet of the south dike, and the driving of several white-oak piles.

On account of the late date at which the contract was let, the repairs to the north branch dike only could be made before the cold weather set in. Work was resumed April 20, 1893, and is now in progress.

During the winter, which was a very severe one, considerable damage was done to the old timberwork of the south dike. It will be replaced under the existing contract.

The material furnished and put in by the contractor to date is as follows:

12,008.4 linear feet pine piling.
167 linear feet white-oak piling.
16,382.1 feet, B. M., yellow-pine square timber.
4,625.7 pounds tie-rods, screw bolts, driftbolts, and washers.

The channel is in excellent condition, and with the completion of the present contract the dikes will be in good repair. They are much exposed, however, to damage by ice and by boats, that frequently run into and break down the timberwork at the intersection of the north and branch dikes.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $2,927.67.

An appropriation of $5,000 is recommended to maintain the dikes in proper repair.

Rondout is in the collection district of New York. The nearest works of defense are those in New York Harbor.

Amounts appropriated.

Act or allotment.	Application.	Amount.
Act June 12, 1872	Diking	$10,000.00
Act March 3, 1873	do	20,000.00
Allotments June 8, 1875:		
From repairs of harbors on Atlantic Coast	Repairs	762.18
From contingencies of river and harbors, etc	do	237.82
Act August 14, 1876	Diking and repairs	30,000.00
Act June 15, 1878	Diking and dredging	30,000.00
Act August 2, 1882	Repairs and dredging	2,000.00
Act July 5, 1884	do	1,000.00
Act August 5, 1886	Repairs	2,500.00
Act August 11, 1888	do	5,000.00
Act September 19, 1890	do	5,000.00
Act July 13, 1892	do	5,000.00
Total		111,500.00
Amount expended to June 30, 1893, inclusive of outstanding liabilities		$109,428.67

Money statement.

Amount appropriated by act approved July 13, 1892		$5,000.00
June 30, 1893, amount expended during fiscal year		1,743.11
July 1, 1893, balance unexpended		3,256.89
July 1, 1893, outstanding liabilities	$1,185.56	
July 1, 1893, amount covered by uncompleted contracts	559.80	
		1,745.36
July 1, 1893, balance available		1,511.53

Amount (estimated) required for completion of existing project	$15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

Abstract of proposals for repairing dikes at Rondout Harbor, New York, received in response to advertisement dated September 8, 1892, and opened October 13, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

Materials.	1. William Parrott.		2. Frederick J. Kelly.	
	Per unit.	Amount.	Per unit.	Amount.
White-oak piles (200 linear feet)....linear foot..	$0.30	$60	$0.40	$80
Pine or spruce piles (7,000 linear feet) linear feet do....	.14	980	.18	1,260
Square timber, yellow pine (20,000, feet, B. M.) M feet B. M..	40.00	800	45.00	900
Tie rods and screw bolts, (11,000 pounds)....pound..	.04½	495	.07	770
Drift bolts, spikes and washers (1,200 pounds).... do....	.04½	54	.06	84
Rubblestone (700 cubic yards)....cubic yard..	1.10	770	1.65	1,155
Total		*3,159		4,249

*Lowest bid.

COMMERCIAL SATISTICS.

The commercial statistics of this harbor have not changed materially since report for 1890, at which time there was a total tonnage of 2,467,490 tons, valued at $41,268,850. General merchandise, coal, cement, lime, bluestone, and ice are the principal products handled, and are carried in about 700 vessels, which also carry 75,000 passengers annually.

Of the above tonnage one-half passes through the Delaware and Hudson Canal, which connects the Hudson River at Rondout with the Delaware River at Port Jervis, N. Y., and with Honesdale, Pa., the heart of the Pennsylvania coal region.

The population of Rondout is 25,000.

E 4.

IMPROVEMENT OF WAPPINGER CREEK, NEW YORK.

Wappinger Creek is a small stream which rises in the northern part of Dutchess County, N. Y., near the boundary with Columbia County, and after flowing for about 40 miles through a rich, fertile valley empties into the Hudson River on the east bank, one-half mile below the village of New Hamburg, N. Y.

The appropriation of $13,000 contained in the river and harbor act of September 19, 1890, is the first ever made by the Government for the improvement of the stream, and is based upon the estimate contained in the report, November 11, 1889, upon the survey of Wappinger Creek from Wappinger Falls to its mouth, made to comply with the river and harbor act of August 11, 1888.

At the time of the survey the creek was navigable for vessels and small barges drawing not over 6 feet in a channel varying in width from 25 feet to 75 feet to Wappinger Falls, 2 miles, approximately, above its mouth, where a series of falls, with an aggregate height of 86½ feet above mean low water, furnish a valuable water power for three industries, the principal of which is the print works of the Dutchess Company.

The project of improvement contemplated a channel 80 feet wide and 8 feet deep from the mouth to the head of navigation at the falls, and the quantity of material required to be excavated was estimated at 45,000 cubic yards.

At the close of the fiscal year ending June 30, 1892, not only was the project completed but additional navigable facilities had been given at the head of navigation by opening a channel 40 feet wide and 8 feet deep from deep water of the main branch of the creek to the Wappinger town dock.

The channel in its present condition meets, it is believed, all the wants of commerce.

Nothing was expended during the fiscal year ending June 30, 1893.

As the approved project has been completed, no further appropriation is recommended for this improvement.

Wappinger Creek is in the collection district of New York. The nearest works of defense are situated upon Governors Island, New York Harbor, and the nearest light-house is Danskammer Point Light-House.

Amount appropriated September 19, 1890	$13,000.00
Amount expended to June 30, 1893, inclusive of outstanding liabilities	12,837.15

Money statement.

July 1, 1892, balance unexpended	$162.85
July 1, 1893, balance unexpended	162.85

COMMERCIAL STATISTICS.

The principal manufactures at the Falls are cotton goods, overalls, clothing, combs, and iron. They are mostly transported by small boats to the mouth of the creek inside of the railroad bridge, where they are transferred to the New York Central and Hudson River Railroad.

The tonnage of the creek during the year 1888 was 70,000 tons. The value of the tonnage was then estimated at $6,500,000. The Dutchess Company shipped 15,500 tons, at an estimated valuation of $5,600,000. The traffic is principally carried by sloops, schooners, scows, canal boats, and barges.

E 5.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

The project for making a navigable water connection between the East River and the Hudson River by the way of the Harlem River and Spuyten Duyvil Creek was formulated upon facts determined by the survey made along this route in 1874, in compliance with the river and harbor act of June 23, 1874, the report upon which may be found on p. 224, Annual Report of the Chief of Engineers for 1875, Part II.

This report contains an interesting historical review of the navigation of the Harlem River from the Revolution to the present time.

A full history of this improvement as now adopted, with the legal proceedings for the acquirement of the land needed for it and copies of the laws passed by the legislature of the State of New York relative thereto, is given in the annual report of the local engineer in charge to the Chief of Engineers for 1887. (See Annual Report of the Chief of Engineers for 1887, Part I, pp. 665 to 689.)

The streams embraced in the improvement are the Harlem River and the Spuyten Duyvil Creek, the former emptying into the East River near Hell Gate and the latter into the Hudson River about 13 miles north of the Battery, and the two together separating Manhattan Island from the mainland.

There has always been an exchange of waters between these two streams at Kingsbridge, though a long ledge of rocks awash at mean low water and an extremely narrow channel at that point have heretofore prevented the exchange being a free one.

High Bridge is practically at the head of navigation in the Harlem River, but there is a fair channel of about 10 feet depth at mean low water as far as Morris Dock, 6 miles from the mouth of the river, and a crooked one of 7 feet depth to Fordham Landing, 1 mile farther; but there is no navigation of this latter section except by rowboats or by small boats used for transporting building material to the "annexed district." Kingsbridge, 1¾ miles from the Hudson River, is the head of navigation in the Spuyten Duyvil Creek, but only at high water for vessels drawing 8 feet.

The range of the tides in Harlem River varies from 5.5 feet at Third Avenue Bridge to 6 feet at the mouth of Dyckman Creek, and in the Spuyten Duyvil Creek is 3.8 feet.

As the difference in the height and times of tides between the East and Hudson rivers, after connection has been made between the Harlem and the Hudson rivers, will produce the currents upon which reliance is placed to keep the channel open, it is desirable that the cross section of the channel be kept as uniform as possible in order to avoid the unnecessary resistances to the flow of the water, which will be caused by any contraction of the waterway.

With this view the contraction of the proposed cut through Dyckman Meadow will be more than counterbalanced by the natural channel through Spuyten Duyvil by the way of Kingsbridge, which is left open; and the contraction caused by the piers and embankments of the High Bridge, which carries the Croton Aqueduct across the Harlem River, should be compensated for by deepening the channels between the piers and abutments of that bridge.

Observations of the tides affecting these waters show that there is not a free exchange of tides between Harlem River and Spuyten Duyvil Creek, but that there is practically a divide somewhere near Fordham Bridge between the tides flowing from the East River into the Harlem River and from the Hudson River into Spuyten Duyvil Creek. Comparing the tides of the Harlem River at Fordham Bridge with those of the Hudson River at the mouth of the Spuyten Duyvil Creek, it is found—

(1) That the level of mean high water in the Hudson is nearly 1 foot (.961 foot) lower than it is in the Harlem.

(2) That the mean rise and fall of the tide in the Hudson is 2.12 feet less than it is in the Harlem.

(3) That the mean duration of the rise of tides in the Hudson is thirty-six minutes shorter and the mean duration of the fall twenty-six minutes longer than in the Harlem.

(4) The mean level of the Hudson at the mouth of the Spuyten Duyvil Creek is .265 of a foot lower than at Fordham Bridge.

(5) High water occurs one hour and thirty-four minutes earlier in the Hudson than in the Harlem.

From these facts it follows that while on the opening of the new channel through Dyckman Meadow there will be a free flow east or

west, dependent upon the stage of the tides, the preponderance will be westward, and that the mouth of the improved channel will then be at the junction with the Hudson River.

The project for the improvement was adopted in 1879. The proposed lines of improvement, as laid down by the engineer in charge in his annual report for 1882, are as follows:

(1) Below the Harlem or Third Avenue Bridge the outer pier and bulkhead lines as laid down by the park department are adopted.

(2) Above the Third Avenue Bridge to the entrance of Dyckman Creek into the Harlem River the exterior pier and bulkhead lines are laid down 400 feet apart.

(3) The line following Dyckman Creek through Dyckman Meadow will pass for a part of the way through solid rock, and it is here that the principal cost of the undertaking must be encountered. This part is to be made 350 feet wide. It would have been preferable to have established it at 400 feet, but the additional amount of rock excavation was the obstacle.

(4) The remainder of the line to the Hudson River will follow, as nearly as possible, the course of the Spuyten Duyvil, and the width will be 400 feet.

(5) The channel depth in the Harlem River and Spuyten Duyvil Creek will be 15 feet at mean low water, and in the channel along Dyckman Creek 18 feet, mean low water.

The cost of opening a navigable waterway from the Hudson River, through Dyckman Creek, to the Harlem River at East Two hundred and eighteenth street, New York City, was estimated in 1875 at $2,100,000, and for dredging the Harlem River thence to Third avenue at $600,000 additional, making the estimated aggregate cost of the improvement $2,700,000.

The project was revised in 1866 by narrowing the channel immediately north of High Bridge to 375 feet where it skirts the Ogden estate on the east bank. This change of width was approved by the Secretary of War October 7, 1886. (See Annual Report of the Chief of Engineers for 1887, Part I, p. 671.)

The legal difficulties for acquiring the right of way along the line of the proposed improvement from the Harlem River to the Hudson River, through Dyckman Meadow, were removed in May, 1887, and immediately thereupon the appropriations of 1878 and 1879, aggregating $400,000, became available and the project for their expenditure was begun and continued under appropriations of 1888 and 1890.

The work contemplated under the existing appropriations provides for the excavation of all the material contained between the dams; and dredging a channel from the east dam through the Harlem River to Fordham Dock, and from the west dam to Spuyten Duyvil Creek. It is expected that when this work is executed there will be a narrow channel between the Hudson and the East rivers, navigable at mean low water by vessels drawing 8 feet.

By act of Congress approved March 3, 1881, a survey was made of the Harlem or Bronx Kills, north of Randall Island, and a report was submitted upon the practicability of opening a channel 300 feet wide and 15 feet deep, mean low water, between the East River and the Harlem River, by this route, at an estimated cost of $2,000,000. The report will be found in the Annual Report of the Chief of Engineers for 1882, Part I, p. 656. The project was never approved by Congress and no appropriation has ever been made for its execution.

Harbor lines for the preservation and protection of the navigable waters of the Harlem River and Spuyten Duyvil Creek were established by the Secretary of War October 18, 1890, under authority of the river and harbor act of August 11, 1888.

BRIDGES ACROSS THE HARLEM RIVER.

The following table shows the location and characteristics of the several existing bridges across the Harlem River:

Name and location of bridge.	Width in clear in each draw.	Height of bottom chords above mean high water.	Remarks.
	Feet.	*Feet.*	
Second avenue	103.7	28.5	Double draw, railroad bridge, iron.
Third avenue	82	13.8	Double draw, road bridge, iron.
Fourth avenue:			
East span	65	7.2	Double draw, railroad bridge, iron; east span closed by row of piling.
West span	68		
Fourth avenue (temporary)	60	1	Single draw, wooden trestle, iron draw span.
Madison avenue	132	28	Double draw, road bridge, iron.
Macomb Dam, One hundred and fifty sixth street (temporary).	76	16.7	Double draw, road bridge, wood; will be removed on completion of new iron bridge at One hundred and fifty-fifth street.
New York and Northern Railway Bridge at Eighth avenue.	128	28	Double draw, railroad bridge, iron.
High Bridge (old aqueduct)			No draw; stone arch; width between piers, 7[illegible] feet; clear waterway, 55 feet; crown of arch, 100 feet above mean high water.
Washington Bridge, at One hundred and eighty-first street.		Single span.	No draw; iron arch; span 500 feet; clear waterway, 420 feet; crown of arch, 136.7 feet above mean high water.
Farmers' Bridge		3.1	No draw; two spans, 22 and 23 feet wide.
King's Bridge		4.8	No draw; two spans, 18 and 25 feet wide.
Foot Bridge at Broadway		3	No draw; two spans, 56½ and 58½ feet wide.
Hudson River Railroad Bridge, at mouth of Spuyten Duyvil Creek.	50	6.9	Single draw, wooden trestle, iron draw span.

The following resolution, governing the closing of the bridges across the Harlem River at Madison and Third avenues when the land transportation over the bridges between the two shores is greatest, was adopted by the department of public parks, New York City, November 30, 1892:

Resolved, That from and after the 20th day of December, 1892, the draws of the bridges across the Harlem River at Madison and Third avenues shall not be opened or operated between the hours of 6 and 10 o'clock in the forenoon and between 4 and 7 o'clock in the afternoon, except when otherwise ordered. This regulation shall not apply to the boats of the fire department nor to the regular transportation boats of the New York and Northern Railway Company.

BRIDGES AFFECTED BY STATE ACTS OR BY NOTICES SERVED BY THE SECRETARY OF WAR.

1. Bridges at Third and Fourth avenues, New York City.—The city of New York, owning or controlling the bridge at Third avenue, and the New York Central and Hudson River Railroad Company, owning or controlling the bridge at Fourth avenue, were notified by the Secretary of War July 2, 1890, to modify these bridges in accordance with the recommendations of the Board of Engineers convened May 7, 1890, to consider, as stated in the Annual Report for 1890, the matter of

bridges across the Harlem River at Third and Fourth avenues, New York City. These notices required that the modifications called for should be completed by January 1, 1892.

The legislature of the State of New York, by act approved April 5, 1892, authorized and required an increased elevation of the Fourth Avenue Bridge, and provided for all changes in any avenues, streets, and railroads that may be necessary by reason of such increased elevation. A commission to carry out the provisions of this act was appointed by the mayor of New York City April 25, 1892. This act will enable the railroad company to reconstruct this bridge in conformity with the requirements of the notice of the Secretary of War, which, in the absence of the necessary legislative action, the company has not heretofore been able to carry out. Plans for the new bridge received the approval of the Secretary of War August 5, 1892.

In order that traffic across the river may not be suspended while the permanent bridge is in process of construction, the railroad company applied to the Secretary of War for authority to build a temporary bridge, provided with a 60-foot draw and situated 160 feet to the northward of the old bridge. This application was granted May 27, 1892. The railroad company began the work of modification in September, 1892, and is pushing it with satisfactory progress.

An act to provide for the reconstruction of the Third Avenue Bridge was approved by the governor of the State of New York May 2, 1892, and plans for the construction of the new bridge, prepared by the department of public works of New York City, received the approval of the Secretary of War March 24, 1893.

The work of modification has not yet begun, but it is expected that the construction of the bridge will begin at an early day.

2. Bridge at Broadway Crossing.—An act of the legislature of the State of New York to provide for the construction of a bridge across the Harlem Ship Canal, locally so called, on the line of Kingsbridge road, or Broadway extended, was approved by the governor April 5, 1892. Plans for the construction of this bridge, conforming to the general provisions of the State act of 1879 as to height of lower chord and length of spans, prepared by the department of public works of New York City, received the approval of the Secretary of War February 11, 1893. The work has been let to contract, and work on the construction of the bridge has been begun.

3. Macomb Dam Bridge.—The State act of April 29, 1890, authorizing the department of public parks of New York City to reconstruct the Macomb Dam Bridge at Seventh avenue was amended by a bill which became a law without the signature of the governor January 31, 1892. The amendment provides that the awards for property taken shall not be paid out of the $1,250,000 appropriated for the bridge. This bridge is now in process of construction under plans approved by the Secretary of War September 7, 1891.

The masonry of the north and south rest piers and of the south abutment is completed; the crib fender work and caisson for the pivot pier are in place, and work on the masonry within the caisson is in progress; and the foundations of the first and second piers of the approach on the north side are under construction.

Application was made by the city of New York, June 14, 1892, for authority to build a temporary bridge 220 feet to the northward of the old bridge, to be used by the public during the construction of the new bridge. This application received the approval of the Secretary of War July 5, 1892, and the bridge was completed August 26, 1892.

4. Bridge at mouth of Spuyten Duyvil Creek.—As stated in the last Annual Report, Mr. Alexander J. Howell, on March 4, 1891, made complaint to the Secretary of War that the railroad bridge across the Spuyten Duyvil Creek at its mouth was an obstruction to navigation by reason of "insufficient width of draw," under the river and harbor act of September 19, 1890.

The matter was referred to the local officer, and public hearings were given April 1 and 15, 1891, to the parties in interest.

The complaint was satisfied by the New York Central and Hudson River Railroad Company agreeing, as a temporary measure only, to widen the draw opening to 50 feet and to erect a steam motor with which to maneuver the drawbridge. This agreement was approved by the Secretary of War June 9, 1891, with the proviso that the modifications agreed upon should be regarded as a temporary measure to meet the necessities of the navigation of the stream as they now exist, and the date fixed for completion of the alterations was December 1, 1891.

Owing to various delays in the preparation of the plans and in letting the work, and further delays on the part of the contractor, the work of erecting the new draw was not begun until April, 1892. The work was completed September 26, 1892.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the beginning of the year two contracts were in force with John Satterlee, one with Lee McCallum, and one with P. Sanford Ross.

The first of Mr. Satterlee's contracts, dated August 12, 1889, calls for the removal of 71,000 cubic yards of earth and 19,000 cubic yards of rock from the cut through Dyckman Meadow, for building an earthen and timber dam to shut out the water of the Harlem River from the site of the work to be done under this contract, and for the construction of timber revetments to protect the sides of the section of canal prism to be excavated; and the second, dated March 9, 1891, for excavating and removing about 37,000 cubic yards of rock and 7,000 cubic yards of earth from the section of canal prism lying between the former contract and the section of canal already completed under an earlier contract.

The contract with Lee McCallum, dated December 29, 1890, and supplementary articles of agreement dated June 23, 1892, call for dredging 380,000 cubic yards, more or less, of mud and earth from the shoal reach in the Harlem River between the easterly limit of the cut through Dyckman Meadow and Fordham Footbridge, and from other shoal and contracted portions of the channel farther east, within the limit of the approved project.

The contract with P. Sanford Ross, dated January 19, 1891, and supplementary articles of agreement dated June 22, 1892, call for dredging about 277,000 cubic yards of mud and earth from Spuyten Duyvil Creek and intervening meadows, between the westerly limit of the cut through Dyckman Meadow and the lift-bridge at the mouth of the creek, in accordance with the approved project.

Under authority granted by the Chief of Engineers, April 19, 1892, an open-market agreement was also in force with B. F. Deniston for the construction of about 800 cubic yards of stone revetment wall for the protection of side slopes in the easterly end of the cut through Dyckman Meadow, the wall to be built of stone taken from the exca-

vation, and to be laid, partly dry and partly in cement mortar, as circumstances might require, at $2.50 per cubic yard for dry stone wall, and $6 per cubic yard for wall laid in mortar.

The two contracts with Mr. Satterlee, dated August 12, 1889, and March 9, 1891, respectively, expired December 1, 1892, and, on the application of the attorney of the contractor, both contracts were extended by the direction of the Chief of Engineers to June 1, 1893.

Operations were continued under the contracts up to April 20, 1893. At about 1:30 o'clock on the morning of April 21, during a severe northeast rain storm, a breach was effected in both dams inclosing the work, by the waters of the Harlem River and Spuyten Duyvil Creek, which had risen to a greater height than ever before observed since the beginning of the work, cutting across the top of the dams, washing out the material of which they were composed, and subsequently flowing from river to river through the breaches made in the dams. At the time of the accident the rock excavation between the dams was completed, with the exception of about 5,000 cubic yards of rock, covering an area of about 80 feet by 100 feet, in the northeast corner of the cut.

Under the terms of the contract the contractor is required to maintain and repair the dams during the continuance of his work; no effort, however, was made by him, either to restore the dams after the accident, or to remove the remaining rock by other means, up to June 1, 1893, when both contracts expired.

As a channel width of over 200 feet had already been secured in the rock excavation, and the small amount of rock remaining could be removed more economically by drilling and blasting in the water than by restoring the dams and again pumping the water from the excavation, it was decided to remove the dams entirely; to make connection between the east and west ends of the rock cut and the 9-foot channel already dredged in the Harlem River and Spuyten Duyvil Creek to within a short distance of the dams; and to undertake the removal of the ledge rock by drilling and blasting in the water, and subsequent removal of the fragments by dredging. Specifications were accordingly prepared for continuing the work under the changed conditions, and submitted to the Chief of Engineers for approval May 17.

Legal considerations affecting the obligations of the late contractor to the United States on failure to complete his contracts, have delayed the decision of the War Department in relation to continuing the work for the expenditure of available balances, amounting at the close of the year to $167,725.90.

As the disaster previously referred to broke land communication between Manhattan Island and Kingsbridge, the city of New York made application, on June 14, 1893, to the Secretary of War, for authority to build a temporary bridge across the improved channel at the point of crossing of the old Kingsbridge Road, to be used as a highway until the permanent iron bridge already authorized by the Secretary of War could be built. No action has yet been taken by the War Department on this application.

The contract with Lee McCallum was continued to October 10, 1892, at which date all the material called for had been removed, and the contract was closed.

The contract with P. Sanford Ross expired on December 31, 1892, and on the application of the contractor was extended by authority of the Chief of Engineers to April 30, 1893. The work under the contract was finally completed on April 26, 1893, when the contract was closed.

Under the foregoing contracts and agreements the following work was done during the fiscal year:

Rock and earth excavated between dams.

	Contract quantity.	Removed during fiscal year.	Removed prior to June 30, 1892.	Total removed under contract.
Under contract dated Aug. 12, 1889:	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*
Rock excavation	19,000	13,316	7,773	21,089
Earth excavation	39,000	926	53,029	53,955
Earth dredging	32,000		11,001	11,001
Total	90,000	14,242	71,803	86,045
Under contract dated Mar. 9, 1891:				
Rock excavation	37,000	11,933	23,934	35,867
Earth excavation	7,000	41	7,938	7,979
Total	44,000	11,974	31,872	43,846

Dredging.

Location.	Contract quantity.	Removed during fiscal year.	Removed prior to June 30, 1892.	Total removed under contract.
Contract with Lee McCallum:	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*
Harlem River	380,000	189,696	190,519	380,215
Contract with P. Sanford Ross:				
Spuyten Duyvil Creek	277,000	194,580	82,420	277,000

Stone revetment wall.—Under the open-market agreement approved April 19, 1892, 404 cubic yards of dry stone wall and 406 cubic yards of wall laid in mortar were built during the year, making a total of 2,110 cubic yards of dry wall and 2,630 cubic yards of wall laid in mortar built to date. The wall built is in five detached sections, two of which are located in the west end of the cut, two in the east end, and one near the middle on the north side. They have a combined length of 730 feet, and vary from 27 to 30 feet in height.

As the result of the year's work the excavation of the section of canal prism lying between the two dams was carried down to grade over an area of 30,450 square feet, completing the cut between the dams with the exception of a ledge of rock, covering an area of about 8,000 square feet in the northeast corner of the cut, which will be removed by drilling and blasting without restoring the dams. All the revetment wall necessary to protect the side slopes of the canal chamber and prevent the loose rock and earth arising from degradation of the banks from falling into the cut after the canal had been opened to navigation has been completed, with the exception of a section about 40 feet in length on the north side near the eastern end, which will also be built without excluding the water from its site.

In the Harlem River the dredged channel, which at the beginning of the year had been excavated from a point about 200 feet east of the east dam to within 900 feet of Fordham footbridge, with a depth of 9 feet at mean low water and width of about 150 feet, was widened and extended southerly about 2,500 feet to a connection with the natural channel at a point 600 yards north of Morris Dock, thus providing a navigable channel 9 feet deep at mean low water and 160 feet wide from the latter point to within 200 feet of the east dam.

A number of large bowlders, aggregating 200 tons in weight, were also removed with the aid of the U. S. drill scow *Hudson* from the chan-

nel at High Bridge and from the crossover directly south of Morris Dock, increasing the navigable depth from 7½ feet at mean low water to 10 feet at the former point and from 6½ feet to 8 feet at the latter.

In Spuyten Duyvil Creek, where at the beginning of the year a channel about 65 feet wide and 8 feet deep at mean low water existed, the channel was widened and straightened by dredging through the point of meadow known as Bell Pumpkin, and also through the point of meadow lying between the Government dock and the west dam, so that at the close of the year a channel 140 to 150 feet wide and 9 feet deep at mean low water was available from the lift bridge at the mouth of the creek to within 140 feet of the west dam.

A survey of the river was made during the year to determine the best manner of applying the appropriation made by the river and harbor act of July 13, 1892. All the necessary data furnished by the survey had been properly studied, but before a project could be prepared to be submitted for the approval of the Chief of Engineers the cofferdams inclosing the working pits of the contractors were breached, as hereinbefore stated, during a severe storm on the night of April 21, 1893, which caused the suspension of all work. The contracts expired June 1, 1893, but the work contemplated by them had not been entirely completed.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $197,411.39.

This improvement can not be well or economically conducted except under large appropriations. The amount that can be profitably expended during the fiscal year ending June 30, 1895, is $500,000.

A full statement of the commerce likely to be benefited by the improvement is subjoined.

Mr. A. Doerflinger, assistant engineer, has been in local charge of this improvement during the year. He has remained constantly upon the work and has discharged his duties with his accustomed fidelity and efficiency.

Harlem River is in the collection district of New York. The nearest light-house is on Blackwells Island.

AMOUNTS APPROPRIATED.

Allotment June 23, 1874, from appropriations for East and Harlem rivers	$11,000.00
Act March 3, 1875	10,000.00
Act June 18, 1878	300,000.00
Act March 3, 1879	100,000.00
Act August 11, 1888	70,000.00
Act September 19, 1890	250,000.00
Act July 13, 1892	175,000.00
	916,000.00
Amount expended to June 30, 1893, inclusive of outstanding liabilities	748,274.10

Money statement.

July 1, 1892, balance unexpended	$190,137.29
Amount appropriated by act approved July 13, 1892	175,000.00
	365,137.29
June 30, 1893, amount expended during fiscal year	186,313.21
July 1, 1893, balance unexpended	178,824.08
July 1, 1893, outstanding liabilities	11,098.18
July 1, 1893, balance available	167,725.90

Amount (estimated) required for completion of existing project.....$1,805,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895..... 500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

As there is no navigable communication between the Harlem River and Spuyten Duyvil Creek, the present navigation of the Harlem River is practically confined to that part of the stream between its junction with the East River and Satterlee's Dock at foot of Two hundred and twentieth street, a distance of about 8 miles.

Spuyten Duyvil Creek is navigable from its junction with the Hudson River to Kingsbridge, a distance of 1¼ miles.

The actual commerce of the Harlem River and Spuyten Duyvil Creek for the fiscal year ending June 30, 1890, and June 30, 1893, was as follows:

Items.	1890.	1893.	
	Tons.	*Tons.*	*Value.*
General merchandise	1,379,334	3,232,052	$159,635,435
Grain, flour, feed, etc	400,987	596,306	15,147,478
Lumber and timber	346,858	451,702	7,462,463
Building material	643,922	602,217	2,791,160
Fuel	508,365	878,234	4,573,836
Ice	112,000	149,865	539,460
Total	3,390,466	5,910,376	190,149,712

The total tonnage for the year 1893 shows an increase over that of 1890 of 2,519,910 tons, or about 75 per cent, during the three years. This increase is largely due to the increase in the amount of freight handled at the docks of the New York, New Haven, and Hartford Railroad Company, directly below Second Avenue Bridge, where alone 3,243,850 tons were received and shipped as compared to 1,407,882 tons received and shipped in 1890. At the docks of the New York and Northern Railway Company, near High Bridge, 166,066 tons were received and shipped. Of the balance of the tonnage, 2,475,275 tons were distributed among the various docks on the Harlem River between its junction with the East River and Satterlee's Dock at Two hundred and twentieth street, and 25,185 tons at various points on Spuyten Duyvil Creek.

As near as can be determined the traffic on the river was carried by the following vessels:

Canal boats, barges, and railroad-car floats	20,361
Sailing vessels, schooners, lighters, etc	4,476
Steamers and tugs, exclusive of naphtha launches	15,241
Total	40,078

A large proportion of the freight handled at the railroad docks is carried in and out of the Harlem on railroad-car floats and transfer boats connecting the railroads of New Jersey and Pennsylvania, terminating at Weehawken, Hoboken, and Jersey City, with those of New England, while the general commerce of the river is carried on mainly in barges and canal boats in tow of steam tugs, and in schooners and the smaller class of sailing vessels.

E 6.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

The East River is the name given to the narrow tidal strait which connects New York Harbor with Long Island Sound. It forms an entrance to the harbor of New York secondary in importance only to

the main entrance by way of Sandy Hook and the Narrows, since the heavy coasting trade carried on by New York and the New England States and the British American provinces passes almost exclusively through it.

The population now gathered around the waters of New York Harbor numbers nearly 3,000,000, and should the present rate of increase, as shown by the census returns, be maintained for half a century longer, the population would then be about 8,000,000.

New York City can grow only in one direction, and that is into Westchester County on the north, since on all other sides it is surrounded by water, and the development of the water fronts along the Hudson and East Rivers must, therefore, be certain and rapid. With the development the importance of the East River entrance to New York Harbor will increase enormously; and it seems not unreasonable to predict that within the next fifty years every foot of shore line on both sides of the East River within 15 miles of Harlem River and Hell Gate will be occupied with wharves filled with shipping engaged not only in the coasting and transatlantic trade but in the commerce of the world.

The East River is crooked and narrow in places and much obstructed by rocks and affected by violent currents.

The worst of these obstructions was originally that known as Hell Gate, lying at the mouth of the Harlem River, between Blackwells and Ward islands, about opposite Ninety-sixth street, New York. Here the river turns at right angles around Hallets Point, divides into several channels, and runs with a velocity, varying at different stages of the tide, from 3 to 10 miles an hour, over or around Hallets Point, Negro Point, Ways Reef, Shell Drake, Pot Rock, Frying Pan, Heel Tap, Holmes Rock, Hog Back, Flood Rock, Hen and Chickens, Gridiron, the Negro Heads, Mill Rocks, Rhinelander Reef, and Bread and Cheese.

On account of the violence and irregularities of the currents and the crowded condition of this passage wrecks at Hell Gate were numerous prior to 1867. At that time some of these rocks projected above the water level, while the least depth over others at mean low water varied from nothing to 20 feet. In obedience to the provisions of the act approved June 23, 1866, an examination was made of Hell Gate by the local engineer, with the view of its improvement for purposes of navigation, and three separate projects were submitted January 21, 1867, for the improvement, affording channels of 26 and 24 feet in depth at mean low water. The project which was adopted in 1867 (see Annual Report of the Chief of Engineers for 1868, p. 741) provided for the removal of the rocks and reefs that lie directly in the channel to a depth of 26 feet at mean low water, and for the building of sea walls and dikes upon others that lie near the edge of the channel, in order to guide the currents in such a way that vessels might pass the reefs in safety. The cost of the project was estimated at $8,692,645.15. The removal of Hallets Point was begun in 1869 and the final blast occurred September 24, 1876. A new estimate was made January 3, 1870, "based upon the process of tunneling the larger reefs, as Hallets Point and the Middle Reef, and removing the smaller reefs by drilling from the surface of the water," and the cost was placed at $4,689,820.

The estimate was again revised in 1874 to include the removal of Diamond and Coenties reefs (see Annual Report of the Chief of Engineers for 1874, Part II, p. 164), and the total cost fixed at $5,139,120. It provides for the removal at Hell Gate to a depth of 26 feet, mean low

water, of the reefs at Hallets Point, Ways Reef, Shell Drake, Pot Rock, Frying Pan, Heel Tap, Negro Point, and Flood Rock, including the Gridiron, Hen and Chickens, and Negro Heads, and the construction of a dike to connect the Mill Rocks and sea walls upon Hog Back and Holmes Rock; and, in other parts of the East River, for the removal of Diamond Reef and North Brothers Island Reef to a depth of 26 feet, Coenties Reef to a depth of 25½ feet, and the small rocks known as Scaly Rock, Blackwells Rock, and the rock off Woolsey's bath house.

The work of mining Flood Rock began in June, 1875.

In 1880 the débris arising from the excavation of the galleries in Flood Rock was deposited partly in a dike to connect Great and Little Mill Rocks, and in 1882 a protection wall was built by the city authorities upon the reef at the head of Blackwells Island known as Bread and Cheese.

The great blast was fired October 10, 1885.

The project was enlarged in 1884 to include the removal of Pilgrim Rock, off Nineteenth street, to 24 feet, mean low water, and again in 1889 to include the removal of the reef off Diamond Reef, Ferry Reef, off Thirty-fourth street, and Charlotte Rock, northwest of entrance to Newtown Creek, to 26 feet, mean low water; work to be done by hired labor with the drill scow.

A steam-drill scow fitted with a movable iron dome working within a central well was put in operation in the winter of 1870–'71 for the removal of subaqueous reefs. Its results have been most satisfactory, as by its use rocks swept by the surface currents of the East River are easily drilled and blasted.

The stone broken by the blasts are sometimes removed by appliances attached to the scow, but usually by use of the Government dredges employed at Hell Gate.

At the close of the fiscal year ending June 30, 1892, the following parts of this project had been executed: Hallets Point, covering 3 acres; Ways Reef, Shell Drake, Diamond Reef, North Brothers Island Reef, Coenties Reef, reef off Diamond Reef, and Scaly Rock had been removed to the depth contemplated on the project; Pilgrim Rock had been reduced to a least depth of 24 feet; Heel Tap had been broken to 26 feet and dredged to 20.5 feet, and the least depths on Frying Pan and Pot Rock were 18 feet and 22.8 feet at mean low water, respecively; Flood Rock and connecting reefs, covering 9 acres, had been broken to 30 feet and 177,376 tons of the débris had been removed; the Negro Heads and Hen and Chickens had been reduced to 18 feet, mean low water, and a new 18-foot channel, 500 feet wide, opened across the reef.

Several cuts running north and south across the long shoal situated on the New York shore between Broome street and Twenty-third street, known locally as "Shell Reef," had been made, giving in the parts so improved a navigable depth of 18 feet at mean low water, the western face of the first cut being 300 feet approximately from the pierhead line of the New York shore. The high points on the southern division of Middle Ground, opposite Sunken Meadow, had been cut down, affording 16 feet at mean low water on the south side of the main reef, and the rock opposite Thirty-fourth Street Ferry, known as Ferry Reef, had been cut down to 22 feet at mean low water.

Hell Gate, as has been said, is the worst obstruction found in the East River; but there are rocks and reefs in other parts of this crowded waterway which are constant sources of danger to passing vessels which have often been complained of and which ought to be removed.

The first to be mentioned is the long line of reefs and isolated rocks

in mid-stream, extending 1½ miles downward from the foot of Blackwells Island, which have always been troublesome to vessels beating up against the wind or crossing from one channel to the other, as the winds and tides often compel them to do, and which, with the continually increasing size of vessels and the increasing commerce of the river, are becoming still more dangerous. The Man-of-War Rock, marked by a spindle, opposite Thirty-eighth street, and the Thirty fourth street rock (now removed) are prominent parts of this reef.

A second and still more serious obstruction to the navigation of the East River that is constantly complained of by mariners is Middle Ground, which is situated in mid-channel 1½ miles to the eastward of Hell Gate, near the southern entrance to Little Hell Gate, between Sunken Meadows and Lawrence Point, with a channel on either side of barely 350 feet width. A project for lowering this reef to the plane of 18 feet, mean low water, has been approved.

The suit begun by private parties to dispossess the United States of its occupancy of the dike built by it between Great and Little Mill rocks, Hell Gate, was decided by the courts in May, 1889, in favor of the United States, but appeal has been taken by the complainant to a higher court. It is highly important that the United States retain possession of the dike, as the ground is very much needed for wharfage and for repair shops for the steam-drill scow and the dredges. The old machinery and worn-out plant and material stored for many years at Hallets Point have been sold at public auction, and the office for the local conduct of this improvement has been transferred to the dike.

The plant in active use on the improvement has been put in good repair during the year.

The Secretary of War established, March 9, 1892, harbor lines around Great and Little Mill rocks, Hell Gate, restricting the construction of piers and bulkheads to high-water line.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

Flood Rock.—Both of the United States engineer dredges *Flood Rock* and *Hell Gate* were kept continuously at work throughout the year.

Dredge *Hell Gate* was employed upon reef off Baretto Point from December 19 to January 17 and upon reef off Sunken Meadow from June 19 to the close of the fiscal year. Dredge *Flood Rock* was employed upon reef off Baretto Point from April 16 to 29. At all other times both dredges were employed, when weather favored, at Flood Rock.

Dredge *Flood Rock* was located at the eastern end of the reef at Hell Gate, working west. Dredge *Hell Gate* was until December 19 located at the southern end, working east, and since February 27 on the western end (Negro Head section), lowering the 18-foot depth, obtained under previous contract, to 26 feet. The dredges have not obstructed the free navigation of the river, as the channels to the northward and to the southward have afforded convenient passage for shipping. It is not advisable, however, to increase the plant at this point, as it is better to defer the final completion of the work than to overcrowd the channel with dredging plant.

The minor repairs necessary to keep the plant in good order were made from time to time without causing any long suspension of work. The heavy ice formed by the severe cold weather during the past winter interfered seriously with the work and compelled a complete suspension from January 7 to February 15 and from February 19 to February 27.

The following table shows in detail the work done during the year:

Operations.	Dredge Flood Rock.	Dredge Hell Gate.	Total.
Days worked	226	147	373
Hours worked	1,769	1,098	2,867
Surface blasts fired	48	6	54
Dynamite fired pounds..	4,250	600	4,850
Rock removed tons..	13,672	7,454	21,126
Raised per day do...	60.49	50.71	

Total removed since explosion, October 10, 1885:

By contract tons..		83,097
By hired labor, using Government plant do...		115,405
Total		198,502

The dredged rock has been dumped, as heretofore, in the deep hole off Eighty-ninth street, East River. This has not caused any perceptible decrease in depth, the soundings there still ranging from 80 to 120 feet, mean low water.

The result of all the work to the close of the fiscal year has been to increase navigable depths practically to 26 feet, mean low water, over an area equivalent to one-half that of the original reef. The bulkhead covering an area of about 100 feet by 100 feet, that has been kept intact for the protection of the dredges against the strong currents, has been reduced in size to about 50 feet by 50 feet and lowered to 14 feet, approximately at mean low water and there is no longer any part of the original obstruction that has over it less than 14 feet, mean low water. No additional width has been gained for the 18-foot channel, which remains, as before reported, at 500 feet.

On September 24, 1890, a special report on this improvement was submitted to the Chief of Engineers, in which the statement is made that for the year ending June 30, 1890, the cost of removing the broken stone by the Government plant was $\$1.08\frac{3}{10}$ per ton, as contrasted with the lowest bid for doing the work by contract in that year of $2.19 per ton. For the year ending June 30, 1891, the cost was $1.35; for the year ending June 30, 1892, $1.46, and for the past year, $1.48 per ton, including the cost of repairs to plant.

The increase of cost for doing the work during the present year over that shown in 1890 is due to the fact that the stone becomes more difficult to remove as the water deepens. The fine material is sifted from the coarse as the grapple rises through the water, and the lower strata becomes gradually covered with powdered fragments which obstruct the free penetration of the teeth of the grapple. Again, it is found that portions of the reef are less broken than others, requiring a larger amount of surface blasting to reduce the blocks to the size which it is safe and economical to raise.

A survey of the reef is now in progress.

Shell reef.—At the opening of the fiscal year the contract with R. G. Packard, dated December 19, 1890, was still in force, but operations under it were suspended to permit necessary repairs to be made to the dredge. Work was resumed August 8 and continued until March 10, at which date the contract was completed. Heavy ice running in the river compelled the withdrawal of the dredge from January 11 to March 1, 1893.

During the fiscal year 48,853 cubic yards of fine material and 313 tons of bowlders weighing 1 ton and over were removed. The t otal quantities removed under the contract are: From Shell Reef 105,092 cubic yards of fine material and 3,871 tons of bowlders weighing 1 ton

and over, and from Middle Ground, opposite Sunken Meadow, 392 cubic yards of fine material and 323 tons of bowlders.

After the contract closed a survey was made, which shows as the result of this work a channel over Shell Reef extending from a line 300 feet eastward of the pierhead line of New York City eastward to the deep-water channel with a practical 18-foot depth at mean low water. Shoal lumps are noticed at a few points, but it is expected that the currents will lower them to the full depth of 18 feet.

Ferry Reef, off Thirty-fourth street.—The U. S. steam drilling scow *Gen. John Newton* continued work on this reef until November 10, 1892, at which time the final sweep with the horizontal bar was made and no point discovered above the plane of 24 feet mean low water.

The operations during the year consisted of drilling and blasting and in removing the broken rock by divers and by the centrifugal pump.

The following table shows in detail the work done during the year at this point, and the total since beginning of operations:

	During fiscal year.	Total to date.
Number of times dome was lowered	11	15
Number of holes drilled	62	85
Total depth of holes drilled.....feet..	334.6	448.6
Actual time running drills.....hours..	64.8	87.8
Average depth of holes.....feet.	5.4	5.3
Number of drill-hole blasts fired	11	15
Number of surface blasts fired	139	440
Pounds of explosive used in drill holes	2,470	3,425
Pounds of explosive used in surface blasts	14,530	58,218
Tons of broken stone raised by divers	316	605
Tons of broken stone raised by pump	353	447
Tons of broken stone removed by dredge		2,863
Total tons raised and dumped	668	3,915
Total cost		$37,761.65
Cost per ton of rock removed		9.64

Reef off Baretto Point.—This was a rocky ledge lying in midchannel between Rikers Island and the continental shore at Baretto Point. The reef embraced an area of 6,500 square feet, and the least depth on it was 17 feet at mean low water.

The U. S. steam drilling scow *Gen. John Newton* began work on this reef on November 11, 1892, and continued there up to May 10, 1893, with an intermission from January 17 to February 14, on account of heavy ice running in the river.

The rock broken by the operations of the drilling scow was removed mainly by dredges *Hell Gate* and *Flood Rock*, the former working on the reef from December 19 to January 17, and the latter from April 16 to 29.

The following table shows in detail the work done on this reef:

Number of times dome was lowered	23
Number of holes drilled	119
Total depth of holes drilled.....feet..	1,222
Actual time running drills.....hours..	87
Average depth of holes.....feet..	10.3
Number of drill-hole blasts fired	23
Number of surface blasts fired	28
Pounds of explosive used (Forcite No. 2)	9,893
Tons of broken stone raised by divers	202
Tons of broken stone raised by pump	137
Tons of broken stone raised by dredge	1,043
Total tons raised and dumped	1,382
Total cost	$16,403.71
Cost per ton of rock removed	11.87

Reef off Sunken Meadow.—The U. S. steam-drilling scow *Gen. John Newton* began operations on this reef May 11, 1893, and continued to the close of the fiscal year. Dredge *Hell Gate* has been employed since June 19 in raising the rock broken by the operations of the drilling scow.

The following table shows the work done during the fiscal year:

Number of times dome was lowered		13
Number of holes drilled		99
Total depth of holes drilled	feet	697
Actual time running drills	hours	68
Average depth of holes	feet	7
Number of drill-hole blasts fired		13
Pounds of explosive used (Forcite No. 2)		5,159
Tons of broken stone raised by divers		57
Tons of broken stone raised by pump		41
Tons of broken stone raised by dredge		666
Total tons raised and dumped		764

The river and harbor act of July 13, 1892, appropriated $150,000 for continuing this improvement. The project for the expenditure of this appropriation, approved by the Chief of Engineers, July 28, 1892, proposed to apply the amount in continuing to raise broken stone from Flood Rock, Hell Gate, by the use of the two United States dredges, and in continuing operations with the steam drilling scow for the removal of obstructive reefs in other parts of the river.

As the running expenses of the Government plant, consisting of two large grapple dredges, one large steam drilling scow, and two tugs, are not less than $8,000 per month, the appropriation of July 13, 1892, provided for eighteen months' work, approximately, and unless further appropriation is made, the work will have to be suspended on December 1, 1893, and the plant laid up.

The expenses incurred on account of this improvement during the year amounted to $157,708.20, of which $6,337.27 remained outstanding at the close of the fiscal year.

The amount that can be profitably expended in the removal of obstructions in East River and Hell Gate during the fiscal year ending June 30, 1895, is $200,000, to be applied to the removal of Flood Rock and of reef off Sunken Meadow, and the removal of rocky obstructions at such other points in the East River as the necessities of navigation demand, notably Charlotte Rock and unnamed rock off Twenty-sixth street, discovered during the year.

The work is in the collection district of New York. The nearest port of entry is New York City. The nearest light is Blackwells Island Light. The nearest fort is Fort Columbus, Governors Island, New York Harbor.

AMOUNTS APPROPRIATED.

Act July 25, 1868	$85,000.00
Act April 10, 1869	178,300.00
Act July 11, 1870	250,000.00
Act March 3, 1871	250,000.00
Act June 10, 1872	225,000.00
Act March 3, 1873	225,000.00
Act June 23, 1874	225,000.00
Act March 3, 1875	250,000.00
Act August 14, 1876	250,000.00
Act June 18, 1878	350,000.00
Act March 3, 1879	250,000.00
Act June 14, 1880	200,000.00
Act March 3, 1881	200,000.00
Act May 4, 1882	50,000.00
Act August 2, 1882	200,000.00

Act July 5, 1884		$360,000.00
Act August 5, 1886		112,500.00
Act August 11, 1888		250,000.00
Act September 19, 1890		200,000.00
Act July 13, 1892		150,000.00
Received from other sources		3,719.62
		4,264,519.62
Deduct amount reverted to United States Treasury	$3,158.55	
Deduct amount allotted to Harlem River	11,000.00	
		14,158.55
		4,250,361.07
Amount expended to June 30, 1893, inclusive of outstanding liabilities.		4,192,142.86

Money statement.

July 1, 1892, balance unexpended	$65,926.41
Amounted appropriated by act approved July 13, 1892	150,000.00
	215,926.41
June 30, 1893, amount expended during fiscal year	151,370.93
July 1, 1893, balance unexpended	64,555.48
July 1, 1893, outstanding liabilities	6,337.27
July 1, 1893, balance available	58,218.21
Amount (estimated) required for completion of existing project	888,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1895	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged and are therefore herein repeated.

The registered tonnage, exclusive of coastwise vessels and local steamers, so far as it can be ascertained, is 10,165,325 tons.

The commerce of the East River is so intimately connected with that belonging to New York Harbor proper that it is impossible to make a separate statement for it.

The following list of vessels, not inclusive of daily passenger and freight steamers, passing through Hell Gate for the fiscal year ending June 30, 1890, has been compiled from the marine records of Whitestone, Long Island, kept by the New York Herald:

	Bound east.	Bound south.
Steamers	642	1,048
Ships	23	13
Barks	115	56
Brigs	80	61
Schooners	5,498	10,528
Tugs	680	682
Barges	2,612	2,862

CHAP. 411.—AN ACT to further amend chapter three hundred and ninety five of the laws of eighteen hundred and sixty-seven, entitled "An act to incorporate the New York and Long Island Bridge Company for the purpose of constructing and maintaining a bridge over the East River between the city of New York and Long Island."

[Approved by the governor May 2, 1892. Passed, three-fifths being present.]

The people of the State of New York, represented in senate and assembly, do enact as follows:

SECTION 1. Section ten of chapter three hundred and ninety-five of the laws of eighteen hundred and sixty-seven, entitled "An act to incorporate the New York and

Long Island Bridge Company for the purpose of constructing and maintaining a bridge over the East River, between the city of New York and Long Island," is hereby amended so as to read as follows:

"SEC. 10. Nothing in this act shall be construed to authorize nor shall it authorize the construction of any bridge which shall obstruct the free and common navigation of the East River, nor the construction of any pier in said river outside the established pier or bulkhead line. Such bridge shall be not less than one hundred and fifty feet elevation above mean high water at the middle of each channel of the river, and shall be so constructed as to provide for the accommodation and transportation of passengers and vehicles of every description for the transportation of freight, and for such other purposes and in such manner as shall, in the judgment of the said company, seem most desirable. Except as in this act otherwise provided the said bridge shall not obstruct any public road, street, or avenue which it shall run over, through, or across so as to prevent the free use thereof by the public; but all such public streets, roads, or avenues shall be spanned from curb to curb by suitable arches or suspended platforms supported by columns, which shall give the necessary height for passage under the same for purposes of public travel and transportation. No street, road, or avenue shall be closed or occupied by said bridge or its approaches without full compensation to the owners of land fronting on the same and injured or damaged by such construction for damages that they may sustain by reason thereof. The said bridge shall commence in the city of New York, east of Park avenue, at or within one mile of the Grand Central depot, for the southern arm or approach, and for the northern arm, either north or south of the Harlem River, with full authority to the said company to locate and build any other bridges necessary to such approach or approaches, and shall cross the East River and Blackwell's Island, or the reefs of rocks south of the same, at right angles to the two channels, at such point between Thirty-second and Ninety-second streets as will afford and give reasonable grades and facility of approach; and the said bridge company shall have the power to locate and construct the said bridge and its approaches and the stations that it may deem necessary in the city of New York and the county of Queens; and the said bridge shall not cross over Park, Madison, or Fifth avenues within a district bounded by Fiftieth street on the south, Ninetieth street on the north, and Third avenue, nor shall the bridge enter into that district. The said bridge shall conform strictly as to its elevation, the form and method of its construction, and the location of its piers and anchorages to the plan thereof heretofore approved by the Secretary of War of the United States, pursuant to the provisions of an act of Congress, approved March third, eighteen hundred and eighty-seven, and entitled 'An act authorizing the construction of a bridge across the East River between the city of New York and Long Island.' The said bridge shall be built with a substantial railing or siding, and shall be kept fully lighted through all hours of the night. The construction of said bridge shall be commenced before the third day of March, eighteen hundred and ninety-three, and the time for the commencement of such construction is hereby extended to such date, and said bridge shall be completed before the third day of March, nineteen hundred. The supreme court shall extend the time herein allowed for the commencement or the completion of said bridge upon satisfactory proof that such commencement or the completion has been delayed by the pendency of legal proceedings, and that the said company has been duly diligent in bringing such proceedings to a final determination. The completion of such construction, unless such construction shall have been delayed by legal proceedings, accidents, strikes, war, or other unforeseen emergencies, shall be deemed to include the erection of such bridge and approaches, and the necessary station or stations in the county of Queens and the city of New York, and such structures as the said company may deem necessary to provide for the connection of said bridge with the Grand Central depot and the yards of the New York and Harlem Railroad, and any other railroads in, over, or under the said city of New York, whether steam, elevated, cable, or electric."

SEC. 2. Section eleven of said act is hereby amended so as to read as follows:

"SEC. 11. If said corporation shall be unable to agree, for any reason, with the owner or owners of any real estate required for its purposes as aforesaid, for the purpose thereof, it shall have the right to acquire the same in the manner, and by special proceedings provided for the condemnation of real property by chapter twenty-three, title one, of the Code of Civil Procedure of the State of New York, and any acts amendatory thereof; and the title thus acquired by the said corporation shall vest in it the fee-simple of the said lands. The said corporation is hereby authorized to use and occupy so much of the lands under water of the East River, not exceeding in parallel length of frontage on each shore of each channel two hundred and fifty feet, as may be necessary for the location and construction of piers and the anchorages of the bridge to be constructed by it according to the plans approved by the Secretary of War, and specified in the last preceding section, provided that no such pier or anchorage shall extend into the said river beyond the established pier

or bulkhead line. If any portion of the land under water required for the construction of the bridge on or near the shore of either Manhattan Island, Blackwells Island or Long Island shall have become the property of any individual, or municipal or other corporation, the same may be taken and acquired by said corporation in the manner and by the special proceedings provided for the condemnation of real property by chapter twenty-three, title one, of the Code of Civil Procedure of the State of New York and any acts amendatory thereof, or in addition thereto; and if any of the sites for the location of the piers and anchorages of said bridge, as shown upon the plan approved by the Secretary of War as aforesaid, consisting in whole or in part of the land or lands under water or above water on Blackwells Island, or the shore thereof or elsewhere, shall be owned or claimed by the mayor, aldermen or commonalty of the city of New York, the commissioners of the sinking fund of the city of New York are hereby authorized and empowered to agree on behalf of said mayor, aldermen and commonalty of the city of New York with said New York and Long Island Bridge Company upon a price or sum to be paid by said company for the use and occupancy of said land or lands under water; and if said commissioners of the sinking fund and the said company are unable to agree upon such price and sum, then said company may take and acquire said land or lands under water, by proceedings under the condemnation act, as above provided, in cases where said corporation can not agree with the owners thereof for the purchase of the same. If any pier or anchorage shown on the aforesaid plan approved by the Secretary of War, as aforesaid, shall be located on any land above or under water heretofore appropriated or acquired for or designated as a public street, the commissioners of appraisal appointed in any proceeding instituted for the acquisition of the site of such pier or anchorage shall include in their report an award to the mayor, aldermen or commonalty of the city of New York of a sum sufficent to defray the cost and expense of the acquisition by said mayor, aldermen and commonalty of the city of New York of sufficient land to widen or deflect said proposed street; and the said street shall thereupon be widened or deflected so as to avoid the aforesaid pier or anchorage."

SEC. 3. The bridge structure or structures to be erected by the corporation hereby amended, its successor or successors, shall be exempt from taxation. And the corporation herein referred to, and its successor or successors, shall be exempt from all taxation until ten years after said bridge shall have been opened for public use, provided, however, that whenever the average gross earnings of said bridge shall have exceeeded three thousand dollars per day for six consecutive months, then the corporation created by the act hereby amended, shall be subject to taxation as provided by law, except as to the bridge structure or structures, and said taxation shall be assessed from the first day of said period. Nothing herein contained shall exempt from taxation any land or lands acquired by said corporation, its successor or successors, for any purpose whatsoever, nor shall anything herein contained be construed as exempting from taxation at any time the structure of any elevated railroad owned, controlled, managed, or operated by said corporation in the county of Queens or in the city of New York, or any other elevated railroad in said cities.

SEC. 4. The president and treasurer of the said corporation shall annually make a verified report to the comptroller or chief fiscal officer of the cities of New York and Long Island City, on or before the first day of November in each year, of the gross amount of its receipts for the year ending September thirtieth, next preceding, and also a detailed account of its daily earnings during that period, and the books of such corporation shall be open to inspection and examination by each of said comptrollers or officers, or the duly appointed agents of either of them, for the purpose of ascertaining the correctness of its report as to its gross earnings. Whenever such earnings shall, during any period of six months, exceed an average of four thousand dollars per day, then, and in that event, the said company shall thereafter annually on the first day of December, pay into the treasuries of the respective cities, in which any portion of any bridge or bridges, or any approach thereto, or any elevated or other railway which may be owned, controlled, managed or operated by said company shall be located, to the credit of the sinking fund of the said cities respectively, a sum equaling in the aggregate one per centum of its gross earnings from the said bridge or bridges, or from any of its approaches or from any such elevated or other railway or railways, and an additional annual payment of one per centum of such gross earnings shall be made by said company in like manner for each multiple of four thousand dollars per day, of such average gross earnings. Such payment shall be in addition to all other taxes to which said company may be subject. The amount thereof shall be annually divided among the treasuries of the cities entitled thereto in proportion to the assessed value of the real estate in each of said cities, as the same shall appear by the last complete assessment rolls of each of said cities. The corporate rights, privileges and franchises acquired by such corporation, if it shall fail to comply with all the provisions of this section, shall be forfeited to the people of the State of New York, and upon judgment of forfeiture rendered in an action brought by the people in the name of the attorney-gen-

eral, shall cease and determine. The payments herein provided for shall be made upon the gross earnings of the bridge herein authorized to be constructed, and upon the gross earnings of any of the approaches thereof, and upon the gross earnings of any elevated or other railway which the said company may at any time acquire, own, manage, control or operate, whether the same shall remain in the possession, control, management or operation of the said company or of any other company or individuals, and shall continue to be so paid in the event of any lease, consolidation, merger or other disposition thereof. And if the said bridge, or any of the approaches thereof, or any such elevated or other railway or railways shall be operated in connection with any other railway or railways, the gross earnings for passengers and property shall not, for the purposes of the payment herein provided for, be decreased thereby.

SEC. 5. The said corporation is hereby empowered to merge and consolidate its capital stock, franchises, and property with the capital stock, franchises, and property of any other corporation or corporations, in the manner and with the effect provided in and by the act known as the "railroad law," being chapter five hundred and sixty-five of the laws of eighteen hundred and ninety, and any act or acts amending or extending, or in substitution of the same, so far as the same are applicable thereto, and said corporation shall further have power to lease its bridge, or any part thereof, its or their appurtenances and approaches thereto, and stations to any corporation or corporations for such time and on such terms as may be agreed upon, power and authority being hereby likewise conferred on such lessee company to accept such lease or leases. In case of consolidation with any other corporations, all the powers hereby conferred on said company may be exercised by the consolidated company, and it shall be lawful for any other corporation to lend its credit to the corporation hereby created, and it shall be lawful for any corporation or any municipality in the State of New York, except where the same may, by the provisions of the constitution of the State of New York, be prohibited from so doing, to subscribe to or become the owner of the stock, bonds, or other securities thereof in like manner, and with like rights as individuals.

SEC. 6. The approaches to such bridge herein mentioned may be extended, if in the judgment of said corporation it shall be deemed for the public convenience so to do, from its central termination in New York City, through private property and along, over, through, and across First or Second avenues for the southerly arm, and through private property and along, over, through, and across First or Second avenues to and across the Harlem River and beyond, so as to connect all existing roads of whatsoever nature, including the location and construction of any bridge over the said river such as may be necessary to its purposes; and the company shall have the right to build and use such stations on these approaches as it may deem necessary to the public convenience. No part of any bridge hereby authorized to be constructed, or its approaches, shall, except at the termini thereof, be less than 16 feet above any street, avenue, or public place, or less than 14 feet above any existing elevated railroad in the city of New York, which may be crossed, intervened, or intersected by any bridge or its approaches. And the said company shall also have the power to construct all necessary approaches other than those hereinbefore specified, and all necessary connections between the said bridge and approaches, and any railroad or railroads in the cities of New York, Long Island City, or Brooklyn, so as to enable passengers and cargo to be transferred rapidly and conveniently to and from the same.

SEC. 7. All acts and parts of acts inconsistent with the provisions of this act are hereby repealed in so far as inconsistent herewith.

SEC. 8. This act shall take effect immediately.

E 7.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

Newtown Creek is a tidal stream about 4 miles long, running through the eastern part of Brooklyn and emptying into the East River opposite Thirty-fourth street, New York. The range of tides is 4½ feet, approximately, but the bed of the creek has no natural slope.

In 1857 it had a depth of about 17 feet, which had decreased in 1880 to about 12½ feet at low water from its mouth up to the Vernon Avenue Bridge, a distance of 1,100 feet, its width for this distance being about

240 feet. Thence it gradually decreased in width and depth until, at the head of navigation, where the Metropolitan avenue crosses it, there was a low-water depth of about 4 feet and a width of about 100 feet.

A survey of this creek with a view of its improvement was made in 1879 by the engineer officer then in charge, to comply with the act of March 3, 1879, and a report submitted January 31, 1880. The project provided for dredging a channel from the mouth of the creek to Vernon Avenue Bridge, 200 feet wide, and from 21 to 22 feet deep at low water, requiring the removal of 145,000 cubic yards of material, chiefly mud, the cost of which was estimated at $36,250.

Work under this project was begun in 1880, but by reason of increased cost of dredging the estimated cost was increased to $44,050.

Under the act of Congress passed August 2, 1882, another survey was made, and a report submitted December 26, 1883. (Annual Report Chief of Engineers, 1884, p. 765.)

The new project provided for carrying the improvement from the Vernon Avenue Bridge up to the head of navigation in both branches of the creek. The estimated cost of executing this project was as follows:

To excavate a channel 18 feet deep and 175 feet wide from Vernon Avenue Bridge to the Central Oil Works, 145,500 cubic yards excavation, at 30 cents	$43,050
Thence 15 feet deep and from 125 to 150 feet wide to Queens County Oil Works, 101,600 cubic yards of excavation, at 35 cents per cubic yard	35,560
Thence 12 feet deep and 125 to 150 feet wide to Nichols's Chemical works, 52,600 cubic yards excavation, at 40 cents per cubic yard	21,040
Thence 10 feet deep and 100 to 125 feet wide to the head of navigation on both branches, 231,600 cubic yards excavation, at 40 cents per cubic yard	92,640
Contingencies	19,229
To which must be added the revised estimate for work below Vernon Avenue Bridge, before given	44,050
Total estimated cost of improving Newtown Creek	255,569

The appropriations of 1884 and 1886 were applied in deepening the channel from the entrance to Vernon Avenue Bridge to 18 feet, mean low water, and from Maspeth avenue eastward to the head of navigation 10 feet, mean low water. The amount appropriated up to and inclusive of act August 5, 1886, was $82,500, of which amount the sum of $50,750 has been applied from Vernon Avenue Bridge to the East River and $31,750 from Covert Dock upstream to the head of navigation on both branches. These appropriations were made in small amounts and at wide intervals, and the work done by them gave only temporary relief. According to these methods the amounts applicable for improvement at the entrance were about sufficient to remove deposits which had been made during the interval, leaving no balance for increasing the depth beyond 20 feet. The improvement could not, for want of funds, be extended to benefit the central reach of the river above Vernon Avenue Bridge, and, in the absence of secure bulkheads, dredging in the upper branches was of little avail. It would have been better had appropriations been made in such a way that the improvement above Vernon Avenue Bridge could have been executed as an extension of the improvement below it. Then, as the improvement advanced upstream, the wharves along the banks would have been benefited progressively and in proportion to their importance.

A revised estimate for the improvement was made in 1889 (Annual Report Chief of Engineers, 1889, Part I, p. 778), after the results ob-

tained by the survey of January, 1889, had been studied, and the cost was fixed at $170,586.

In preparing the new project for the improvement it was kept in mind that the draft of vessels going above Vernon Avenue Bridge, where the most important wharves are located, was limited by the then available depth of water, and that many vessels had to be lightered at the bar to facilitate entrance at high tide, while those going out had to complete their cargoes after they reached the East River. It was, therefore, thought best to provide for 21 feet from the entrance to Vernon Avenue Bridge, 18 feet to Central Oil Works, 15 feet to Queens County Oil Works, 12 feet to Nichols's Chemical Works, and 10 feet to Metropolitan Avenue Bridge on both branches.

The bed of the creek below Vernon Avenue Bridge is variable in character below the plane of 18 feet, mean low water. Near the bar it is composed of sand or sand and clay mixed; but as the bridge is approached it grows harder, like hardpan, and has large bowlders embedded in it. The creek has a very sluggish current, and where there are no bulkheads the deposits arising from the sewers and from the degradation of the soft and unstable banks cause obstructions to navigation, for which annual dredging is the only possible relief.

The river and harbor act of September 19, 1890, appropriated $35,000 for continuing the improvement, and was applied throughout the main river, giving 21 feet at the entrance and 10 feet at the head of navigation. In the "English Kills," a northern branch of the river skirting Laurel Hill, a channel was made 700 feet long, 100 feet wide, and 10 feet deep, mean low water. The contract was closed August 24, 1891.

The following table shows the location and characteristics of the several bridges crossing Newtown Creek:

Name and location of bridge.	Width of draw.	Height of bottom chord above mean high water.	Remarks.
	Feet.	*Feet.*	
Vernon Avenue Bridge.	63	7.3	Road bridge; double draw; iron on wooden pier; opens by hand power.
Blissville Bridge (Greenpoint avenue).	58	8.9	Road bridge; double draw; wood on wooden pier; opens by hand power.
Penny Bridge (Meeker avenue).	53	9.7	Road bridge; double draw; iron on stone pier; opens by hand power.
Grand Street Bridge ...	57	5.8	Iron on stone pier; single draw road bridge; opens by hand power.
Metropolitan Avenue Bridge (Metropolitan avenue and Grand street junction).	62	8.7	Road bridge; double draw; iron on stone pier; opens by hand power.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the opening of the fiscal year no contract was in force.

The river and harbor act of July 13, 1892, appropriated $35,000 for continuing the improvement. The project for the expenditure of this appropriation, approved by the Chief of Engineers July 23, 1892, proposed to continue the approved project by widening the 15-foot channel from Central Oil Works to Queens County Oil Works, and the 12-foot channel from Queens County Oil Works to Nichols's Chemical Works; and by opening a channel 100 feet wide and 10 feet deep from Nichols's Chemical Works to Maspeth avenue, and from Maspeth avenue to Metropolitan avenue (west branch).

Advertisements and specifications were issued August 8, 1892, invit-

ing proposals to be opened September 14, 1892. The bids received were all considered too high, and were accordingly rejected. Readvertisements were issued September 26, 1892, and proposals opened November 3, 1892. The bid of Thomas Potter, the lowest bidder, was accepted, and contract entered into with him November 17, 1892.

Work began under this contract December 15, 1892, and was completed March 27, 1893, during which time there had been removed the following quantities of material:

	Cubic yards.
From Central Oil Works to Queens County Oil Works	11,500
From Queens County Oil Works to Nichols Chemical Works	15,225
From Nichols Chemical Works to Maspeth avenue	33,634
From Maspeth avenue to Metropolitan avenue:	
West branch	28,022
East branch	3,600

At the close of the fiscal year the channel from the entrance to Vernon Avenue Bridge is 175 feet wide at the entrance and 150 feet wide near the bridge, and is 18 feet deep, mean low water. The channel from Vernon Avenue Bridge to Central Oil Works is 80 feet wide and 16 feet deep, mean low water; from Central Oil Works to Queens County Oil Works, 100 feet wide and 14 feet deep; from Queens County Oil Works to Nichols Chemical Works, 75 feet wide and 10 feet deep; from Nichols Chemical Works to Maspeth avenue, 50 feet wide and 10 feet deep; from Maspeth avenue to Metropolitan avenue, on the east branch, 100 feet wide and 10 feet deep; and on the west branch, 50 feet wide and 10 feet deep. In the English Kills branch the channel is 100 feet wide and 8 feet deep from Nichols Chemical Works to a point 700 feet to the eastward.

Notices of the Secretary of War dated April 11, 1892, have been served upon the supervisors for Kings and Queens counties, New York, requiring the bridge across the creek at Meeker avenue to be altered in such a manner as to place the outer faces of the abutments on the legal bulkhead line, and to provide a draw opening on either side of the pivot pier 65 feet wide in the clear. Upon application of the supervisor, the Secretary of War extended the date for the completion of the proposed alterations from October 1, 1892, to January 1, 1893. On account of difficulties in acquiring private property involved in the construction of the abutments on the Long Island City side, the alterations have not yet been completed, but it is expected that the work will be finished by September 1. The delay is not detrimental to commercial interests.

A complaint was made to the Secretary of War by the Newtown Creek Towing Company, June 5, 1893, that the bridge across the creek at Vernon avenue was an obstruction to navigation and its mode of operation inadequate to meet the demands of navigation. A report was made June 19, 1893, recommending that the bridge should be entirely demolished and replaced by a new structure with draw openings not less than 89 feet in the clear, and operated by steam or electricity. Notices of public hearing to be held July 13, 1893, were served on the parties interested.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $36,051.86.

The estimate of $78,000 recommended for the fiscal year ending June 30, 1895, will, if appropriated, complete the project of 1883; and if the improvement is to be continued thereafter a new project and estimates will be required.

This work is in the collection district of New York; nearest port of entry, New York City; nearest lighthouse, Blackwells Island light; nearest fort, Fort Columbus.

Amounts appropriated.

Application.	Date.	Amount.
Dredging below Vernon Avenue Bridge	June 14, 1880	$10,000
Do	Aug. 2, 1882	15,000
Part applied above Vernon Avenue Bridge	July 5, 1884	20,000
Below and above Vernon Avenue Bridge	Aug. 5, 1886	37,500
Newtown Creek and Bay	Aug. 11, 1888	25,000
Do	Sept. 19, 1890	35,000
Do	July 13, 1892	35,000
Total		177,500

Amount expended to June 30, 1893, inclusive of outstanding liabilities..... $177,500

Money statement.

July 1, 1892, balance unexpended	$1,051.86
Amount appropriated by act approved July 13, 1892	35,000.00
	36,051.86
June 30, 1893, amount expended during fiscal year	36,051.86
Amount (estimated) required for completion of existing project	78,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	78,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Newtown Creek, New York, received in response to advertisement dated August 8, 1892, and opened September 14, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Material to be dredged. From Central Oil Works to Queens County Oil Works, 11,000 cubic yards. Per cubic yard.	Amount.	From Queens County Oil Works to Nichols Chemical Dock, 9,900 cubic yards. Per cubic yard.	Amount.	From Nichols Chemical Dock to Maspeth avenue, 28,800 cubic yards. Per cubic yard.	Amount.
1	Atlantic Dredging Co	$0.55 / .50	$6,050 / 5,500	$1.25	$12,375	$0.33	$9,504
2	Thomas Potter	.40	4,400	1.00	9,900	.26	7,488
3	Morris & Cumings Dredging Co	.50	5,500	1.25	12,375	.33	9,504

No.	Name of bidder.	Material to be dredged. From Maspeth avenue to Metropolitan avenue (west branch), 28,500 cubic yards. Per cubic yard.	Amount.	From main branch (east branch), 3,150 cubic yards. Per cubic yard.	Amount.	Total.
1	Atlantic Dredging Co	$0.44 / .41⅔	$12,540 / 11,875	$0.44 / .41⅔	$1,686.00 / 1,312.50	$41,855.00 / *40,422.50
2	Thomas Potter	.33⅓	9,500	.33⅓	1,050.00	†32,338.00
3	Morris & Cumings Dredging Co	.42	11,970	.42	1,323.00	40,672.00

*If restricted to eight hours work per day.
†If unrestricted in regard to working hours; lowest bid.

Abstract of proposals for improving Newtown Creek, New York, received in response to advertisement dated September 26, 1892, and opened November 3, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Material to be dredged.					
		From Central Oil Works to Queens County Oil Works, 11,500 cubic yards.		From Queens County Oil Works to Nichols Chemical Dock, 14,140 cubic yards.		From Nichols Chemical Dock to Maspeth avenue, 28,800 cubic yards.	
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.
1	Atlantic Dredging Co	$0.40	$4,600	$0.95	$13,433.00	$0.26½	$7,632
2	Morris & Cumings Dredging Co	.40	4,600	.80	11,312.00	.26	7,488
3	Elijah Brainard	.39	4,485	.79	11,170.60	.27	7,776
4	Thomas Potter	.40	4,600	.70	9,898.00	.26	7,488

No.	Names of bidders.	Material to be dredged.				Total.
		From Maspeth avenue to Metropolitan avenue (west branch), 32,750 cubic yards.		From main branch (east branch), 3,620 cubic yards.		
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	
1	Atlantic Dredging Co	$0.32	$10,480.00	$0.32	$1,158.40	$37,303.40
2	Morris & Cumings Dredging Co	.33	10,807.50	.33	1,194.60	35,402.10
3	Elijah Brainard	.33	10,807.50	.33	1,194.60	35,433.70
4	Thomas Potter	.29	9,497.50	.29	1,049.80	*32,533.30

*Lowest bidder in aggregate.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

Imports and exports.

Articles.	Amount.		Value.
	Imported.	Exported.	
Lumber, feet, B. M.	263,040,852	21,000,000	$5,936,994
Coal, tons	440,410		1,652,794
Oil, cases		2,937,273	2,900,000
Oil, gallons	19,949,255	29,252,557	3,026,509
Residuum, do	20,093,200	1,378,148	623,438
Grain, bushels	140,000		140,000
Brick	125,000,000		650,000
Lime and cement, barrels	260,000		260,000
Stone and sand, tons	105,000		107,000
Chalk, do	20,000		70,000
Tin, lead, iron, and steel, do	9,776	500	905,791
Oil of vitriol, pounds	20,457,437		135,840
Jute, hemp, manila, etc, tons	200,000		2,000,000
Empty barrels and cases	577,058	1,036	460,033
Naphtha, gallons		6,464,226	381,983
Candles and wax, pounds		11,765,064	
Separated acid, gallons		1,035,695	19,366
Miscellaneous, tons		24,075	2,236,521
Total			22,045,745

Vessels arriving and departing.

Class.	Number.	Tonnage.
Steamers	12	15,240
Ships	26	51,200
Barks	125	87,500
Brigs	13	10,400
Schooners	22,226	1,113,000
Lighters	1,022	204,400
Barges	2,782	556,400
Canal boats	3,068	306,800
Total	9,274	2,324,940

There were built on Newtown Creek 23 new vessels, 7,200 tons capacity, and valued at $265,000.

E 8.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

Buttermilk Channel is the name given to the channel which separates Governors Island, at the mouth of the East River, New York Harbor, from the city of Brooklyn, which lies east of it.

The channel on the northwest side of Governors Island, which separates it from the lower end of the city of New York, is the wider and deeper of the two, and is the channel most used by vessels passing between the East River and other parts of New York Harbor.

Buttermilk Channel was formerly obstructed by three shoals:

(1) A shoal lying above and northeast of Governors Island, projecting into Buttermilk Channel and extending over to the main channel on the other side, which originally had a least depth over it of 9½ feet at mean low water.

(2) A shoal putting out from Red Hook Point, on the Brooklyn side, and extending up the eastern side of the channel to the entrance of the Atlantic Basin, with a least depth on it of about 6 feet at mean low water and an average depth of from 10 feet to 12 feet mean low water.

(3) A shoal putting out from the southern side of Governors Island and extending towards the Red Hook Point Shoal, which is partly dry at mean low water.

Between the first-mentioned shoal and Governors Island there was formerly a narrow channel with 30 feet of water in it, and between this shoal and the Brooklyn shore a channel of the same depth, also originally narrow.

A narrow and crooked channel about 30 feet deep lies between the two latter shoals.

The line of docks and wharves from the Brooklyn Bridge down to the mouth of the Atlantic Basin on the Brooklyn side is one of the most important in the New York Harbor, and this part of the river, extending from the Brooklyn Bridge to Governors Island, was formerly regarded by pilots and masters of vessels as one of the most difficult places in New York waters to carry a vessel through safely on account of this shoal, the rapid current, and the enormous traffic passing not only up and down but across the stream.

Tows, tugs, small steamers, and small craft generally, in passing up and down this part of the East River, keep to the New York side, forc-

ing the larger class of sound steamers, ocean steamers, and seagoing ships in tow of tugs to keep over towards the shoal at the upper point of Governors Island, and if, as was often the case, these vessels were obliged to stop in order to avoid collision with ferryboats, sloops, and canal-boat tows, they were liable to drift upon this shoal.

Upon a statement of these difficulties, made by shipping merchants and others whose business lay along the Brooklyn wharves between Wall Street Ferry and the Atlantic Basin, a survey of this shoal was ordered in 1872, and a project for its improvement was adopted in 1880.

The appropriations made by the several river and harbor acts from June 4, 1880, to August 11, 1888, both inclusive, have been so applied as to complete the removal of this shoal to a depth of 26 feet, mean low water, at an estimated cost of $346,000.

The contract for final work was closed July 3, 1891.

The river and harbor act of September 19, 1890, made provision for the survey of Red Hook Shoal, lying at the southern entrance to the Buttermilk Channel, "opposite the southeast side of Governors Island," and the report thereon, dated October 17, 1890, states that the shoal contains 1,484,048 cubic yards of material, scow measurement. The estimated cost of removal was $529,000.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

At the opening of the fiscal year no contract was in force.

The balance available on the completion of the contract expiring July 3, 1891, was $25,000, approximately. The only place where it could be applied was at Red Hook Shoal, but since that shoal is 2,500 feet long and 1,000 feet wide, with an average depth of less than 10 feet of water at mean low water, and in the vicinity of the buoy marking its western border is composed of compact sand covered with bowlders, the available balance was too small to widen the channel or lower the shoal in a way to benefit navigation appreciably. Besides this, the dredges, which alone could do the work, were already engaged, and it was not possible that they could be secured within a reasonable time, except at excessive rates, not justified by the circumstances.

It was therefore deemed best to hold the money in the Treasury until it could be judiciously used in connection with the appropriation to be made by the succeeding river and harbor act, towards the removal of the western half of the shoal, in the execution of a project formed for straightening the channel at the southern entrance.

The act of July 13, 1892, appropriated $100,000 for improving Buttermilk Channel.

Sealed proposals for doing the work of dredging so much of Red Hook Shoal as the appropriation permitted were opened September 13, 1892, and a contract was made September 26, 1892, with the International Contracting Company, the lowest bidder, at 32.7 cents per cubic yard.

Work under the contract was begun May 1, 1893, and at the close of the present fiscal year 32,308 cubic yards of material had been removed; 26,387 cubic yards were taken from the eastern end near the entrance to the Atlantic Basin, and 5,921 cubic yards from the northwestern edge of the shoal near black buoy No. 2. The shoal will be removed by successive cuts, extending from the buoy towards the Brooklyn shore.

When the shoal is entirely removed Buttermilk Channel, opposite Atlantic Basin, will be 1,000 feet wide, and the set of the currents will be so direct along the southern margin of Governors Island that the

improved depths of 26 feet will be maintained with reasonable certainty, without the necessity for an artificial bank to be built upon that island or upon the shoal extending from it to the southwestward.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $12,821.24.

An appropriation of $200,000 is recommended towards the completion of this improvement, which is required to facilitate the navigation of the southern entrance to Buttermilk Channel, now obstructed by the Red Hook Shoal.

This work is in the collection district of New York. The nearest port of entry is New York City, and the nearest work of defense Fort Columbus, New York Harbor. The nearest light-house is Robbins Reef.

Amounts appropriated.

Application.	Date.	Amount.
Dredging	June 4, 1880	$60,000
Do	Mar. 4, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	56,250
Do	Aug. 11, 1888	100,000
Do	July 13, 1892	100,000
Total		446,250
Received from other sources		100
Total		446,350

Amount expended to June 30, 1893, inclusive of outstanding liabilities. $334,327.99

Money statement.

July 1, 1892, balance unexpended		$24,843.25
Amount appropriated by act approved July 13, 1892		100,000.00
		124,843.25
June 30, 1893, amount expended during fiscal year		6,489.44
July 1, 1893, balance unexpended		118,353.81
July 1, 1893, outstanding liabilities	$6,331.80	
July 1, 1893, amount covered by uncompleted contracts	100,615.28	
		106,947.08
July 1, 1893, balance available		11,406.73

Amount (estimated) required for completion of existing project..... 404,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Buttermilk Channel, New York, received in response to advertisement dated August 4, 1892, and opened September 13, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging 340,000 cubic yards material from Red Hook Shoal.		Remarks.
		Per cubic yard.	Amount.	
1	R. G. Packard	$0.55	$187,000	
2	Morris and Cumings Dredging Co	.65	221,000	
3	The International Contracting Co	.32.7	111,180	Lowest bid.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

The commerce of Buttermilk Channel is so intimately connected with that of New York Harbor that it is impracticable to determine the amount and value.

The number and tonnage of vessels loading and unloading at the Brooklyn wharves, immediately fronting on Buttermilk Channel, during the fiscal year ending June 30, 1890, as shown by the Maritime Register, is as follows:

Vessels arriving and departing.

Class.	Number.	Tonnage.
Steamers	1,047	1,430,102
Ships	253	389,996
Barks	1,632	783,360
Brigs	312	99,600
Schooners	714	214,200
Total	3,958	2,917,348

This does not include the numerous lighters and canal boats, of which no record is kept.

E 9.

IMPROVEMENT OF GOWANUS BAY, RED HOOK, GOWANUS CREEK, AND BAY RIDGE CHANNELS, NEW YORK HARBOR.

Gowanus Bay is a part of New York Harbor lying at the mouth of Gowanus Creek in the southwestern part of the city of Brooklyn. The depth of water in the channel was formerly 7 to 12 feet at mean low water, which was wholly insufficient for the passage of the vessels employed in the commerce of the district. A survey of Gowanus Bay and Creek was made in 1880, and a project for the improvement was submitted in January, 1881.

This project provided for dredging a channel on the north side between the pier lines established by the commissioners appointed by the State of New York in 1875, beginning at the bay and extending up the creek to Hamilton Avenue Bridge 18 feet at mean low water, and 200 feet wide, except for the upper few hundred feet near the bridge, where the width was to be gradually reduced from 200 feet to 100 feet.

The total length of the proposed channel was about 9,000 feet, and the total estimated cost of improvement was $182,500.

The proposed channel, however, did not follow the old channel at the mouth of the creek, since the pier line established by the State commission of 1875 crossed the old channel at that point and encroached upon the water grant of the riparian owners.

The owners of this property, Messrs. Beard & Robinson, were anxious, nevertheless, to have the old channel improved instead of having the new one formed, as proposed, outside of the established pier line; but as this could not be done they surrendered their right to build out to the pier line. They signed a paper relinquishing their right to build piers which should obstruct the old channel so long as that channel

should be permitted to exist; and the Maritime Association of New York at the same time petitioned that the old channel should be kept open. As the improvement of this channel would, however, help only the land near it on the north side, and not at all that which lay on the opposite or southerly side of the creek, the local officer recommended that the conflict of interests should be settled by dredging the natural channel from the Hamilton Avenue Bridge down to the southwest corner of the Erie Basin; and that from that point two channels be dredged, one running northerly along the west side of the Erie Basin to deep water, near Red Hook, and the other running across the bay at the entrance and thence southerly along the wharves on the south side of the bay, towards Bay Ridge.

Both of these channels were to be 200 feet wide and 18 feet deep at mean low water.

This project required for its execution a larger amount of work than the original scheme called for, namely:

The excavation of 583,530 cubic yards of material, which, at 30 cents per cubic yard, would cost	$175,059.00
Contingencies, 10 per cent	17,505.90
Total	192,564.90

In the absence of any special governmental legislation, legal measures conforming to State requirements and necessary for securing the right of way across Beard & Robinson's property, at the mouth of the creek, were completed satisfactorily, after some delay, in May, 1883, and under appropriations of 1881, 1882, and 1883 the proposed Red Hook branch of the channel was dredged 100 feet wide for a length of 2,000 feet, measured from Red Hook, and the southern channel, running towards Bay Ridge, was begun at the southern end and carried northward for a distance of 1,900 feet, to near Forty-third street, with depths varying from 21 to 17 feet, except for a few hundred feet at the upper end on the eastern side, where the last cut was left unfinished.

The sum of $7,500 was appropriated by the act of August 5, 1886, and was applied towards the improvement of the Red Hook and Gowanus Creek Channel, which at the close of the contract for dredging, March 12, 1887, was 200 feet wide and 18 feet deep from the entrance to the foot of Court street, Brooklyn, and thence 40 feet wide and 15 feet deep to Sigourney street.

A sketch of the work, June 30, 1885, may be found in the Annual Report Chief of Engineers for that year, Part I, p. 672.

Under the estimates of $192,564.90 only $72,500 had been appropriated to June 30, 1887.

In the Annual Report for 1888, p. 615, the local officer stated that the dimensions previously adopted for the two channels were too small in view of the great increase in length and draft which had taken place lately in the construction of sea-going vessels, especially steamers, and recommended that the depth of these channels be increased to 21 feet, mean low water, and their width to 400 feet, while to facilitate the handling of vessels in the contracted space near the mouth of Gowanus Creek, and to enable those drawing 21 feet of water to pass directly from the Bay Ridge Channel at Fortieth street to the Red Hook Channel at the southwestern entrance to Erie Basin, without requiring them to go to the junction of the channels at Twenty-eighth street, it was further recommended that the triangular shoal area separating the two channels at the entrance be deepened to 21 feet, mean low water.

It was estimated that these changes would involve the removal of 1,345,000 cubic yards of material, measured in place, as follows:

Red Hook Channel (from entrance to Henry street):		
To deepen it to 21 feet	cubic yards..	70,000
To widen it to 400 feet	do....	100,000
		170,000
Gowanus Creek Channel (from Henry street to Hamilton Avenue Bridge):		
To deepen it to 21 feet	cubic yards..	350,000
To cut away at the angle	do....	300,000
		650,000
Bay Ridge Channel (from Twenty-eighth street to Sixteenth street, South Brooklyn):		
To deepen it to 21 feet	cubic yards..	250,000
To widen it to 400 feet	do....	275,000
		525,000
Total, in place	cubic yards..	1,345,000
Which, at 40 cents per cubic yard, would cost		$538,000
Contingencies		62,000
Total		600,000

The river and harbor act of August 11, 1888, making appropriations for continuing the improvement, reads as follows:

Continuing the improvement by dredging to 21 feet, mean low water, and widening the channel to 400 feet on the northerly side from the foot of Percival street along the wharves to the 23-foot curve opposite the entrance to Erie Basin, $60,000.

This provided for the commencement of the first and second parts of the project recommended in 1888. The required width of 400 feet at the entrance could not be obtained without dredging inside the pierhead and bulkhead line established by the State in 1875, and the upper 3,000 feet of the creek could not be made 400 feet wide without interfering with the vested rights of property on the west side to such a degree as to practically prohibit the execution of the project. The project which was accordingly adopted for the application of the appropriation provided that the channel to be ultimately dredged should be 400 feet wide from the entrance to the eastern end of the Erie Basin, and carried thence 250 feet wide to the foot of Percival street, where provision would be made again for widening the channel by dredging out the three triangular spaces or slips on the north side immediately below that street.

Operations under the contract of February 27, 1889, for the removal of 300,000 cubic yards of material from Red Hook and Gowanus Creek Channel, extending from the entrance near the western entrance to Erie Basin to Percival street, were completed February 26, 1891, and the channel was then throughout 100 feet wide and 21 feet deep, mean low water.

The river and harbor act of September 19, 1890, appropriated $60,000 for improving the channel at Gowanus Bay, New York, to be applied on the northerly side (Red Hook and Gowanus Creek channels), from the foot of Percival street along the wharves to the 23-foot curve opposite the entrance to the Erie Basin.

The contract for this work, which was dated January 8, 1891, was completed April 30, 1892. The channel was then 230 feet wide from

entrance to Twenty-eighth street and 150 feet wide thence to Percival street.

The same act appropriated $100,000 for a channel 400 feet wide and 21 feet deep on the south shore (Bay Ridge Channel), from Twenty-eighth street south along that shore to the 21-foot curve near Bay Ridge.

The contract for the work, dated January 8, 1891, was completed June 18, 1892. The channel was then 120 feet wide from Twenty-eighth street to Thirty-ninth street and 90 feet wide thence to Sixtieth street.

The adopted project for the improvement of this bay, therefore, contemplates a channel on the north and south sides of the bay each 400 feet wide and 21 feet deep at mean low water, and the removal also to the depth of 21 feet of the triangular shoal at the entrance to the bay embraced between the two channels.

Harbor lines were established by the Secretary of War March 4, 1890, on both shores of Gowanus Bay.

To remove any misapprehension as to their exact location on the *north shore*, it seems best to repeat that the pierhead and bulkhead lines so established are coincident throughout from the foot of Ferris street to Hamilton avenue, South Brooklyn. They lie *exterior to the Erie Basin* and follow to the foot of Court street the exterior sea-wall line established by chapter 398, Laws of the State of New York, 1875; and thence to Hamilton avenue follow the bulkhead line established by chapter 763, Laws of New York, 1857.

In regard to the harbor lines for the *south shore* of Gowanus Bay (along the Bay Ridge Channel), adopted by the Secretary of War March 4, 1890, attention is invited to the fact that "the piers between the adopted pier and bulkhead lines may be filled with solid material when an equal tidal prism is provided in compensation therefor behind the authorized bulkhead lines and adjacent to said piers." (Annual Report Chief of Engineers, 1890, p. 815.)

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

General improvement, Red Hook and Gowanus Creek Channels.—At the opening of the fiscal year no work was in progress.

The river and harbor act of July 13, 1892, appropriated, for continuing improvement, $100,000, "for distribution by allotment between Red Hook and Gowanus Creek Channels at the discretion of the Secretary of War."

A project, providing for the expenditure of $58,000 on Red Hook Channel and $42,000 on Gowanus Creek Channel, was approved by the Secretary of War August 4, 1892. Under this project advertisement and specifications were issued August 6, 1892, inviting proposals to be opened September 14, 1892. On account of informalities in the proposals of the two lowest bidders, all bids were rejected by direction of the Secretary of War, and the work was readvertised October 27, the proposals to be opened December 21, 1892.

The proposal of the International Contracting Company to dredge the material at 13.7 cents per cubic yard was accepted, with the approval of the Secretary of War, and a contract was entered into with that company under date of January 6, 1893.

Work under this contract began May 22, 1893, with one large clamshell dredge, but, owing to mechanical defects in the construction of the machine, its efficiency has not equaled expectations,

The quantity removed under this contract at the close of the year is 13,331 cubic yards.

The amount expended on this channel during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $2,405.40.

Bay Ridge Channel.—No operations were in progress at the opening of the fiscal year.

The river and harbor act of July 13, 1892, appropriated $98,600 for completing improvement.

This work was included in the advertisement for Red Hook and Gowanus Creek Channels, and in the contract with The International Contracting Company, dated January 6, 1893, at the price of 13.7 cents per cubic yard.

Operations on this channel began June 17, 1893, with one small dipper dredge.

The contract for the work provides for its completion by August 1, 1894.

The quantity removed from Bay Ridge Channel under this contract at the close of the fiscal year, is 6,996 cubic yards.

The amount expended on this channel during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $29,363.06.

The amount that can be profitably expended upon the improvement of Gowanus Bay channels during the fiscal year ending June 30, 1895, is $250,000, which amount should be appropriated in one sum for distribution by allotment between the Red Hook and Gowanus Creek and Bay Ridge channels and the triangular area between them at their junction, at the discretion of the Secretary of War.

Gowanus Bay is in the collection district of New York City. Nearest light, Robbins Reef. Nearest work of defense, the fort on Governors Island, 1 mile to the northward.

Amounts appropriated.

Application.	Date.	Amount.
Dredging	Mar. 3, 1881	$40,000
Do	Aug. 2, 1882	20,000
Do	July 5, 1884	5,000
Do	Aug. 5, 1886	7,500
Do	Aug. 11, 1888	60,000
Do	Sept. 19, 1890	160,000
Do	July 13, 1892	198,600
Total		491,100

Amount expended to June 30, 1893, inclusive of outstanding liabilities.. $295,088.89

Money statement.

July 1, 1892, balance unexpended		$29,179.57
Amount appropriated by act approved July 13, 1892		198,600.00
		227,779.57
June 30, 1893, amount expended during fiscal year		28,983.66
July 1, 1893, balance unexpended		198,795.91
July 1, 1893, outstanding liabilities	$2,784.80	
July 1, 1893, amount covered by uncompleted contracts	173,260.20	
		176,045.00
July 1, 1893, balance available		22,750.91

Amount (estimated) required for completion of existing project 281,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1886 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving channels in Gowanus Bay, received in response to advertisement dated August 6, 1892, and opened September 14, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging 440,000 cubic yards from Bay Ridge Channel.		Dredging 280,000 cubic yards from Red Hook Channel.		Dredging 190,000 cubic yards from Gowanus Creek Channel.		Total.
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	
1	The International Contracting Co	Cents. 19.7	$86,680	Cents. 19.7	$55,160	Cents. 19.7	$37,430	*$179,270
2	Atlantic Dredging Co	35	154,000	30	84,000	42	79,800	317,800
3	The W. H. Beard Dredging Co.	23.64 19.7	104,016 86,680	21.9	61,320	27.6	52,440	†217,776
4	P. Sanford Ross	28	123,200	24.50	68,600	32.4	61,560	‡181,480 253,360
5	Morris & Cumings Dredging Co	27½	119,350	34.50	68,600	33	62,700	250,650

*Lowest bid. †If restricted to eight hours work per day.
‡If unrestricted in regard to working hours per day.

Abstract of proposals for dredging channels in Gowanus Bay, New York, received in response to advertisement dated October 27, 1892, and opened December 21, 1892, by Capt. D. D. Wheeler, assistant quartermaster, U. S. Army, in the official absence of Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging 440,000 cubic yards from Bay Ridge Channel.		Dredging 280,000 cubic yards from Red Hook Channel.		Dredging 190,000 cubic yards from Gowanus Creek Channel.		Total.
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	
1	Morris & Cumings Dredging Co	Cents. 16.50	$72,600	Cents. 16	$44,800	Cents. 21	$39,900	$157,300
2	Atlantic Dredging Co	17.50	77,005	17.50	49,000	17.50	33,250	*159,250
3	The International Contracting Co	13.7	60,280	13.7	38,360	13.7	26,030	†124,670
4	The W. H. Beard Dredging Co. ‡	15.5	68,200	14.7	41,160	18.9	35,910	145,270

* Price for all the channels together. † Lowest bid.
‡ For the three channels together, 15.7 cents per cubic yard.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

[For the year ending December 31, 1889.]

Receipts and shipments.

Articles.	Quantity.	Value.
Coal tons..	687,000	$2,748,000
Brick number..	202,000,000	1,414,000
Lumber feet, B. M..	147,000,000	2,940,000
Lime, etc barrels..	460,000	690,000
Grain bushels..	2,750,000	1,100,000
Ice tons..	230,000	805,000
Roofing tar barrels..	75,000	225,000
Building stone, etc		647,000
Miscellaneous		2,500,000
Total		13,069,000

Vessels arriving and departing below Hamilton Avenue Bridge.

Class.	Number.	Tonnage.
Steamers	46	33,211
Ships	68	105,741
Barks	489	441,614
Brigs	56	17,627
Schooners	281	57,392
Total	890	655,585

Vessels arriving and departing above Hamilton Avenue Bridge (record of bridge tender).

	Times opened and closed.	Vessels passed through.	Registered tonnage.	Daily average of times opened.
June 1, 1889, to May 31, 1890	8,624	7,668	1,430,664	28
1886	7,632	6,071	985,431	21
Increase	992	1,597	445,233	7

Classification of vessels.

	Number.	Registered tonnage.	Draft.
			Feet.
Schooners	1,393	172,738	6–12
Sloops	972	62,925	6–10
Barges	1,625	409,486	6– 8
Canal boats	3,678	785,515	6– 8
Total	7,668	1,430,664	

The increase in value of receipts and shipments compared with 1887 is $749,000. It is believed that the values as stated in 1887 are too large, and that the true increase is very much larger.

Bay Ridge Channel.—These statistics, repeated from last year's report, are not included in the previous table:

Material.	Value.
Asbestos, cement, paint, and roofing	$2,225,000
Brick and lumber	350,000
Export sugar, machinery and castings	175,000
Petroleum and its products	3,300,000
Phosphates	350,000
Ship and yacht building, dry docks, machine and boiler works, and other industries	1,000,000
Total	7,400,000

There are large factories and piers building along the line of the channel, which will enhance the tonnage and values.

Of larger vessels, such as ships, barks, etc., about 300 have been at the docks. From observation, it is estimated that there are about 1,200 of smaller craft.

A large proportion of the vast commerce of the port, which was carried on in vessels of great draft, could only cross these shoals at or near high water.

The reasonable demand which had been made in 1884 by commercial bodies residing in New York City that increased facilities should be afforded for entering the port of New York by the Sandy Hook route was recognized in the river and harbor act of July 5, 1884, which provided for "deepening Gedney Channel through Sandy Hook Bar, New York, $200,000."

A few words upon the subject of the lower harbor and of the various channels across the bar at the entrance are here necessary for a proper understanding of the causes which led to the adoption of the Main Ship Channel for improvement.

Gedney Channel is the main channel across the Ocean Bar, lying at the entrance to New York Harbor, about 3 miles outside of Sandy Hook and east by north of it. Sandy Hook lies about 9 miles outside of and nearly south from the Narrows, which is the name given to the strait separating the nearest points of Long Island and Staten Island, and the Narrows, in turn, are about 7 miles south from the Battery at the extreme southern end of Manhatten Island, upon which New York is situated. The Narrows are about 1 mile wide. That part of New York Harbor lying outside of the Narrows is commonly known as the Lower Bay.

From the Narrows northward to New York City there is no water less than 6 fathoms (36 feet) deep in the main channel.

Lower Bay is a large tidal basin, with an area of about 100 square miles, estimating inside or northward and westward of a line drawn from Sandy Hook to Coney Island.

The western end of the bay formed by Sandy Hook, the adjacent Jersey shore, and Staten Island, is known as Raritan Bay, and the southern part of it inside the peninsular of Sandy Hook is known as Sandy Hook Bay, or more commonly as the Horseshoe.

From the northwest around by the east to south-southeast the Lower Bay is open to the full sweep of the Atlantic Ocean.

From the Narrows to the northern point of Sandy Hook is about 9 miles, but the shortest distance across the bay, from the point of Sandy Hook to Coney Island, is 7 miles. The water cross section on this line at mean low water is about 790,000 square feet, through which the mean velocity is, approximately, 1.6 feet per second; but the maximum velocities are approximately twice as great (Board of Engineers' report for 1884).

At the Narrows the channel is about 1 mile wide and 70 feet deep, with depths in it of over 100 feet.

Below the Narrows there is one main channel, commonly known as the Main Ship Channel, running southward to a point about 1 mile west of the upper end of Sandy Hook; thence turning at right angles northward and eastward for 4 miles to the head of Gedney Channel, and thence through Gedney Channel east to the deep waters of the ocean.

But along and inside the above-mentioned cross section, 7 miles between Sandy Hook and Coney Island, there is a wide shoal with five distinct channels of varying depths running through it seaward and eastward.

They lie in the following order, beginning at the northward:

(1) *The Coney Island Channel.*—In which the navigable depth at mean low water is 10 feet.

(2) *The Fourteen-Foot Channel.*—In which the navigable depth at mean low water is 15 feet.

(3) *The East Channel.*—In which the navigable depth of water is 19 feet.

(4) *The Swash Channel.*—Through which 22 feet can be carried at mean low water in a narrow channel.

(5) *The Main Ship Channel.*—In which, prior to 1885, 24 feet only could be carried through different reaches with lumps in them, over which the depth was only 23.3 feet at mean low water. The northern reach, which passes along the west side of Flynn Knoll, is maintained by tidal flow through the Narrows; and the southern reach, along Sandy Hook, is maintained by tidal flow through Raritan Bay.

These five channels are separated by shoals with from 4 to 18 feet of water over them at mean low water.

The first three of these channels head directly out into the open sea; but the two latter converge into an area of about 2 miles square, lying north and east of Sandy Hook, which has a depth in it of 30 feet of water and over, and from this deep area two channels lead eastward into the open sea over the outer bar, the northernmost known as Gedney, the southernmost as the South Channel, both of which had, prior to 1885, only 24 feet of water in them at low water. Gedney Channel, the wider, was originally the deeper and straighter of the two and was therefore used by all the large vessels.

The Swash Channel is really a cut-off from the Main Ship Channel, leaving it about 6 miles below the Narrows, and joining it again at the western end of Gedney Channel.

Apart from being shoaler, the Swash is much narrower than the Main Ship Channel.

The distance from the Battery, at New York, to 30-foot soundings outside the bar in Gedney Channel, is 22 miles, and by the Swash it is 18 miles, or from the Narrows 15 and 11 miles, respectively.

As the appropriation of 1884 was made in advance of an approved project, the local officer was authorized and directed to make a survey of the Lower Harbor from the eastern end of Coney Island to Sandy Hook with the view of determining the most feasible plan of improvement. The survey was completed in November, 1884, and a report recommending the eventual improvement of the Main Ship Channel, accompanied with estimates of cost and chart, was submitted December 6, 1884. (Annual Report, Chief of Engineers, 1885, p. 773.)

The navigation of the Main Ship Channel, inside the bar, especially on the approach to the Narrows from the Southwest Spit, is so intimately connected with that of Gedney Channel across the bar that it was deemed important, in submitting an estimate of cost for the improvement of the latter channel directed to be made by Congress in the act of 1884, to extend the estimate to include the entire Main Ship Channel at Flynn Knoll, and to recommend that the improvements at several intermediate shoals should take place simultaneously. The project providing for deepening the channel across the bar to 28 feet by dredging and for the contingent construction of a stone dike on the north side of the harbor which had been recommended by a Board of Engineers, December 24, 1884, received the approval of the Secretary of War December 27, 1884. (Annual Report, Chief of Engineers, 1885, Part I, p. 774.)

The project under which the improvement began provided for improving the western end of Gedney Channel for a length of 4,000 feet,

measured along its axis, and the Main Ship Channel, west of Flynn Knoll, from Buoy No. 10, at the western end of the Southwest Spit, north of Buoy No. 12, then situated 1½ miles south of the western entrance to Swash Channel, the depth to be 30 feet mean low water.

The cost was estimated at $970,000, not inclusive of any allowance for irregularities of cutting, or for increase of bulk for scow measurements. After the work had progressed for one year, and these allowances could be estimated with some degree of accuracy, the estimate was revised, and the cost of executing the project as then approved was fixed at $1,370,000.

The river and harbor act of August 5, 1886, containing provisions for continuing the improvement at the entrance to New York Harbor, read as follows:

> Improving New York Harbor, New York: To secure a 30-foot channel at mean low water at Sandy Hook entrance of the harbor, upon such a plan as the Secretary of War may approve, $750,000.

By the specific wording of this act Congress gave an express approval of an improvement which contemplated a navigable channel 1,000 feet wide and 30 feet deep, mean low water, through the Main Ship Channel and Gedney Channel, and all subsequent acts have confirmed the provisions of the act of 1886.

In 1887 the project was enlarged so as to embrace a length of 4,500 feet in Gedney Channel, measured along the axis, or a length of 6,000 feet, measured along the north side; to remove the shoal in the Main Ship Channel at the southern entrance to the Swash Channel, afterwards called the "Bayside Channel;" to remove the shoal northwest of Sandy Hook; and to extend the Main Ship Channel north from Buoy No. 12 to and beyond the northern entrance to the East Channel, at Buoy No. 14 (now Buoy No. 10). The total estimated cost of the project so enlarged, based on the existing prices for dredging, was $1,490,000.

The river and harbor act of August 11, 1888, appropriated $380,000 for continuing the improvement.

The river and harbor act of September 19, 1890, appropriated $160,000 for continuing the improvement, making the total amount appropriated at that date $1,490,000, the total estimated cost of the improvement.

The first operations began September 26, 1885, and the plant which has been used for the execution of the improvement has consisted solely of centrifugal pumps, and the excavations been deposited beyond the bar in the vicinity of the Scotland light-vessel.

The quantity which has been removed from the several reaches of the Main Ship Channel, extending from the head of the East Channel to deep water beyond the bar through Gedney Channel, from September 26, 1885, to June 30, 1892, may be classified as follows:

	Cubic yards.
From Gedney Channel	1,161,244
From Bayside Channel	448,313
From Northwest Shoal	118,758
From west of Flynn Knoll	3,146,764
Total quantity excavated	4,875,079

The protection of the eastern and northern shores of Sandy Hook, composed of irregular sand dunes, against wave and current action

forms part of the project for improvement of the Main Ship Channel through the lower harbor, but as the work required to be done there was necessarily tentative, it was deemed best to limit expenditures to small sums of money annually while studying the most economical plan of improvement.

Sandy Hook, like the more southerly part of the coast of New Jersey, where the foreshore is a long, submerged shoal, has had a varied experience in changes of form and extent resulting from tidal and current action, supplemented by wave action during storms.

The eastern shore along False Hook Channel is a long, unbroken beach, remarkably uniform in its contours, and, as it is under the cover of the outlying shoals, has undergone few changes either of accumulation or degradation.

From the northeast corner of the Spit, where the outer shoal has diminished width, westward around the Hook to beyond the Hook Beacon, the north shore is open to northerly and easterly storms, and is particularly subject to frequent changes, and it is on this front that the shore protections have been laid.

The great ravages made there by the sea in 1863 made shore protection an immediate necessity, and during the next twenty years many points were protected along the crown of the Hook from east to west, the improvements taking the form of jetties extending out, at varying angles with the shore line from near high-water to below low-water mark.

The Main Ship Channel hugs this shore, and the water at a distance of less than 2,000 feet has a depth of over 60 feet. The slope of the foreshore is somewhat steep, and as the main object of the improvement was to preserve the high-water line and the dunes behind it, there being no marked tendency of the currents to cut below the low water line, it was thought best to place the outer ends of the jetties near the latter curve. To have anchored the jetties in deep water, under the circumstances, would have been unjustifiably expensive.

Some of the jetties were built of timber, some of timber, brush, and broken stone, and others of concrete, either in bags or in forms. In 1883–'84 the timber jetties, which were in a state of decay, were wholly replaced by concrete, built in place and arranged in sections 10 feet long, so that when undermined, either at the end or on the sides, settlement would be by sections without fracturing the body of the jetty.

The cement used was a brand of American Portland. The general cross-section area of the jetties was 50 square feet. While these jetties served to cover a certain part of the shore line for certain winds, it was noticed that they gave no protection to the high-water line during storms from any direction which were coincident with spring tides. In the latter case, no matter what the direction of the wind, the cliffs, at or near the high-water mark, were attacked and degraded by the waves.

To prevent the complete destruction of the cliffs, and to arrest the recession of the high-water line before the foundations of the defenses and other public buildings were reached, it was decided in 1890 to run a riprap wall just below the high-water line completely around the Hook, uniting all the jetties.

The work which was begun in May, 1890, was continued to completion in September, 1891. The wall is 2,575 feet long, extending from Jetty No. 1 to about 119 feet westward of Jetty No. 11, and had a cross section when first laid of 50 to 60 square feet.

The stones vary in weight from 300 pounds to 3 tons, and are laid directly upon the beach, with the purpose that each stone shall arrange its bed at once after the sea attack, allowing a gradual settlement of the wall without sudden dislodgment of the stone. The cost was $6 per running foot of wall.

During the past three years the whole wall has settled gradually, with very little lateral displacement of stone, but it has perfectly shielded the cliffs during the northerly and easterly storms, while the jetties have caused the beach pockets to fill up during the intervals of southerly seas, causing the low-water line to move outwards. As the result of the improvement the beach is gradually building up, and the high-water line is moving outward.

The amount expended upon this protection since 1890 aggregates $19,095, and the cost, including repairs for settlement, was $7.41 per running foot of wall.

A survey made in June, 1893, shows that the Hook has moved to the westward 250 feet during the year. On the northern face where unprotected by the sea wall, it has been cut away from 20 to 80 feet. The high-water line between jetties No. 10 and No. 11, the most exposed part of the protected shore line, has moved slightly outwards.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

No contract was in force at the beginning of the fiscal year.

The river and harbor act of July 13, 1892, appropriated $170,000 for continuing improvement. The project for the expenditure of this appropriation, approved by the Chief of Engineers July 20, 1892, provided for the purchase or construction of a steam dredging vessel for use in maintaining the improved depths resulting from the completion of the original project. Advertisement and specifications were issued August 4, 1892, inviting proposals to be opened September 11, 1892. The proposal of the only bidder, Mr. Joseph Edwards, for the sale of the steamer *Reliance*, previously employed by him in executing contract work for this improvement, at $72,500, the steamer to be in "first-class condition in all particulars," was accepted.

The steamer, after being thoroughly overhauled and put in good order by the bidder, was turned over to the United States on December 1 for one month's trial. At the expiration of the trial month, the requirements of the specifications in regard to condition and supply of extra parts having been fully complied with, the steamer was accepted.

The project for the employment of this steamer for the expenditure of the balance of the appropriation, act July 13, 1892, approved by the Chief of Engineers November 15, 1892, provides for improvement as follows:

(1) Widening to 2,000 feet south entrance to Main Ship Channel, west of Buoy No. 12, at the western end of Southwest Spit, the turning point for passing from the deep-water channel north of Sandy Hook (Bayside Channel) to the channel leading northward towards the Narrows.

(2) Swash Channel, by cutting off projecting point on west side, westward of Romer Beacon, and removing isolated lumps in mid-channel so as to afford a channel whose least width shall be 600 feet, and least depth 26 feet at mean low water.

(3) Removal to the depth of 26 feet at mean low water of Craven Shoal, lying near the west bank of the upper channel opposite quarantine station south of the Narrows.

The steamer, whose name has been changed to *Gedney*, was employed from December 1, 1892, to June 5, 1893, in enlarging the width of the southern entrance of the Main Ship Channel on the north side of Sandy Hook Bay, and from June 6 to the close of the fiscal year in widening and deepening south side of Swash Channel, westward of Romer Beacon, so as to afford a depth of 26 feet, mean low water.

The work of the steamer is very satisfactory; from the Main Ship Channel, where the material consists of mud and fine sand, two loads, aggregating 1,200 to 1,400 cubic yards, were removed daily in favorable weather, and from the Swash Channel, where the material is coarse sand, four loads, aggregating 2,400 to 2,500 cubic yards. This material is deposited in deep water southeast of the Scotland Light-ship, a distance of 10 miles from the Main Ship Channel and 7 miles from the Swash Channel, making an aggregate distance of 40 miles and 56 miles, respectively, run daily in going to and from the dumping ground. The net cost for the month of June, 1893, is 9.5 cents per cubic yard, and the net cost from December 1 to date is 17.8 cents per cubic yard, based on all expenses incurred in running the steamer, including wages of crew, cost of coal and supplies, and all repairs made to date. The price per cubic yard under the last contract was 23.9 cents.

A project to connect the Main Ship Channel, New York Harbor, with the Government wharves at Fort Hamilton and Fort Wadsworth by channels 100 feet wide and 10 feet deep, mean low water, was approved by the Chief of Engineers May 26, 1893.

After inviting sealed proposals in accordance with law, an open-market agreement was made with the W. H. Beard Dredging Company, to do the required dredging at 39 cents per cubic yard.

Work under this agreement began June 10, and was completed June 23, 1893. At Fort Wadsworth 1,000 cubic yards of hard material, including bowlders, were removed, affording a navigable approach to the wharf 100 feet wide, and 10 feet deep. At Fort Hamilton 8,787 cubic yards of light material, consisting of sand chiefly, were removed, affording a channel 100 feet wide, 10 feet deep, mean low water, and 600 feet long from deep water to the wharf, with a turning basin 100 feet by 200 feet in front of the wharf.

No work was done during the fiscal year on the sea wall for the protection of the north shore of Sandy Hook.

The annual running expenses of the steamer *Gedney*, including wages of crew and cost of repairs, coal and supplies, office expenses, and surveys, are $75,000 approximately. The amount available at the close of the fiscal year is $80,172.63, sufficient to provide for one year's work terminating June 30, 1894.

Mariners have made no complaint during the year that the channel has not adequate depth of water. The examinations made by this office from time to time indicate that the improved depths have been well maintained.

An appropriation of $150,000 is recommended to provide for running expenses of the dredging steamer *Gedney* for two years.

The amount expended on the improvement of New York Harbor during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $116,371.72.

The improvement by dredging and rock removal in and about New York Harbor has been under the supervisory charge of Mr. G. W. Kuehnle, assistant engineer, to whom I am indebted for the most sat-

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated.

The following statement concerning the commerce of New York Harbor is taken from the report of the Chamber of Commerce of the State of New York for the year 1889–'90:

Articles.	Imported.		Exported.		Total value.
	Quantity.	Value.	Quantity.	Value.	
Sugar.....pounds..	1,463,051,343	$42,943,453			$42,943,453
Molasses.....gallons..	8,498,875	1,424,251			1,424,251
Coffee.....pounds..	455,979,016	58,860,319			58,860,319
Tea.....do....	58,476,531	9,643,514			9,643,514
Manufactures of wool, silk, cotton, and flax.....		111,234,883		$7,728,397	118,963,280
Cotton.....pounds..			536,614,048	54,701,315	54,701,315
Leather and hides.....		25,760,160		4,906,214	30,666,374
Tin.....pounds..	327,279,151	14,825,588			14,825,588
Raw silk and wool.....do..	55,505,689	13,949,577			13,949,577
Hemp, jute, sisal grass, etc ..tons..	149,263	13,431,215			13,431,215
India rubber and gutta-percha, crude.....pounds..	28,652,361	11,094,063			11,094,063
Tobacco and manufactures.....		10,147,883		15,291,084	25,438,967
Furs and manufactures.....		4,748,971		4,724,017	9,472,988
Earthen, stone, and china ware....		3,230,780			3,230,780
Wines.....		6,156,821			6,156,821
Coin and bullion.....		7,274,618		69,724,274	76,998,892
Precious stones.....		9,498,209			9,498,209
Miscellaneous.....		135,203,820		75,006,102	210,209,922
Breadstuffs:					
Wheat.....bushels..			9,086,407	8,449,510	8,449,510
Wheat flour.....barrels..			3,335,195	15,498,193	15,498,193
Corn.....bushels..			26,658,970	13,066,961	13,066,961
All other breadstuffs.....				1,765,287	1,765,287
Provisions.....pounds..			753,007,846	64,504,425	64,504,425
Mineral oils.....gallons..			418,773,072	36,049,956	36,049,956
Cattle.....			75,004	6,204,624	6,204,624
Oil cake and meal.....pounds..			231,034,183	3,032,066	3,032,066
Foreign merchandise.....				16,727,560	16,727,560
Total.....		479,428,125		397,379,985	876,908,110

This table shows an increase of $24,642,419 over the total value of imports and exports for the preceding year, which amounted to $852,165,691.

Commercial statistics of the port of New York, from July 1, 1892, to July 1, 1893.

Amount of revenue collected	$138,032,031.18
Value of all imports	675,537,058.00
Value of all exports	519,010,369.00

	Number.	Registered tonnage.
		Tons.
Foreign vessels entered	3,798	6,021,562
Foreign vessels cleared	3,700	5,701,760
American vessels from foreign ports entered	1,093	939,558
American vessels from foreign ports cleared	808	964,070
Coastwise vessels entered	2,398	
Coastwise vessels cleared	2,725	

Statement of the number and tonnage of all vessels belonging to the port of New York, June 1, 1893.

	Number.	Registered tonnage.
		Tons.
Steam vessels	1,051	413,851.84
Sailing vessels	1,507	293,936.06
Barges	637	138,744.68
Canal boats	31	5,836.50

E 11.

IMPROVEMENT OF JAMAICA BAY, NEW YORK.

Jamaica Bay is a tidal bay, situated on the south side of Long Island near the western end, whose waters flow into the Atlantic Ocean through Rockaway Inlet.

Inside the entrance there is a deep-water basin, from which one navigable channel leads to the northward in the direction of Canarsie, and another, called Beach Channel, to the eastward, behind Rockaway Beach, in the direction of Far Rockaway. From the eastern terminus of one of the branches of the latter channel, which passes through Conch Hole, an artificial cut into Far Rockaway Bay was made several years ago by citizens to enable small boats to pass eastward through that bay into Hempstead Bay and beyond.

The river and harbor act of September 19, 1890, contained provision for a survey "from main channel from Jamaica Bay easterly to Long Beach Inlet, for canal."

The usual preliminary examination was made according to law, and the local officer stated in his report dated December 16, 1890 (Annual Report, Chief of Engineers, 1892, p. 840), that in his judgment the western part only of the waterway mentioned in the act, extending from the main ship channel, Jamaica Bay, easterly through Conch Hole to the Citizens' Cut at Far Rockaway, was "worthy of improvement," to the extent of opening a connecting channel 60 feet wide, affording 5 feet depth at mean low water.

A survey of the bay was authorized to be made, and a report was submitted thereon October 29, 1891 (Annual Report, Chief of Engineers, 1892, p. 845), which gave estimates of cost for the opening of a new waterway across the eastern part of the bay 60 feet wide and 5 feet deep, mean low water, following three different routes, viz:

(1) From Conch Hole to western end of Citizens' Cut	$21,406
(2) From entrance to Bass Channel to Citizens' Cut	18,920
(3) From entrance to Bass Channel to foot of Bayswater avenue, Far Rockaway	9,460

The river and harbor act of July 13, 1892, appropriated $9,460 for "completing improvement in accordance with plan numbered 3, of Lieut. Col. Gillespie, Corps of Engineers, submitted December 16, 1890."

This is the first appropriation ever made for the improvement of the eastern part of Jamaica Bay.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

A project for the expenditure of the appropriation of July 13, 1892, approved by the Secretary of War, July 25, 1892, provided for the completion of the project as directed by the act.

Advertisement and specifications were issued August 15, inviting proposals to be opened September 20, 1892. The bid of Elijah Brainard, the lowest bidder, was accepted, and contract was entered into with him October 13, 1892, at 25⅛ cents per cubic yard.

Operations began under this contract May 9, 1893, and at the close of the fiscal year, 13,845 cubic yards of material had been removed, and 2,200 feet of the channel had been dredged to the full projected width of 60 feet and depth of 5 feet, mean low water.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $3,727.61.

No appropriation is recommended for the fiscal year ending June 30, 1895, as the appropriation made by the river and harbor act of July 13, 1892, is for the full amount estimated to be required for the completion of the project.

Jamaica Bay is in the collection district of New York. The nearest fort is at Fort Hamilton, Gravesend Bay, and the nearest light-house is located upon Norton Point, Coney Island, New York Bay.

Amount appropriated, act July 13, 1892 $9,460
Amount expended to June 30, 1893, inclusive of outstanding liabilities 3,727.61

Money statement.

Amount appropriated by act approved July 13, 1892		$9,460.00
June 30, 1893, amount expended during fiscal year		1,368.15
July 1, 1893, balance unexpended		8,091.85
July 1, 1893, outstanding liabilities	$2,359.46	
July 1, 1893, amount covered by uncompleted contracts	5,063.94	
		7,423.40
July 1, 1893, balance available		668.45

Abstract of proposals for improving Jamaica Bay, New York, received in response to advertisement dated August 15, 1892, and opened September 20, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging 34,000 cubic yards material.		Remarks.
		Per cubic yard.	Amount.	
1	Alonzo E. Smith	$0.34	$11,560.00	
2	Elijah Brainard	.25½	8,542.50	Lowest bid.
3	John P. Randerson	.32	10,880.00	If limited to eight hours' work per day.
		.29	9,860.00	If allowed to work ten hours per day.

COMMERCIAL STATISTICS.

The amount of commerce which it is alleged will be benefited by the improvement has been estimated at 500,000 tons. The vessels which now navigate the eastern part of Jamaica Bay are usually of the class engaged in the oyster trade, and number 100 probably. A larger class of boats may be drawn into the trade on the completion of the project for improvement.

E 12.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

Raritan Bay forms the western part of the large triangular bay inclosed between Sandy Hook, the New Jersey shore, and Staten Island, the eastern part of which is commonly known to New Yorkers as the Lower Bay, as it lies just outside of or below New York Harbor, which is the name usually applied to the inner body of water on which the city of New York is situated.

The Raritan River flows into Raritan Bay at its extreme western end, passing between Perth Amboy and South Amboy, and Newark Bay is connected with both the Raritan River and Bay by the Arthur Kill or Staten Island Sound, which, separating Staten Island, belonging to the State of New York, from the New Jersey shore, enters Raritan Bay at Perth Amboy.

The depth of the bay varies from 5 to 30 feet, decreasing gradually toward its western and southern shores.

The natural channel leading out of it toward the eastward, after passing the Great Bed Lights at the junction of Staten Island Sound and the Raritan River, does not follow the middle of the bay, but hugs the Staten Island shore for nearly 4 miles to Seguine Point, situated about half a mile east of Princes Bay Light, then it runs southeastwardly toward the inner point of Sandy Hook, about 2 miles, crossing a shoal which puts out toward the southward from the Staten Island shore.

In 1880, before any improvement had been made here by the Government, 18 feet of mean water could be carried through from Perth Amboy to Great Beds Light, 21 feet from Great Beds Light to Seguine Point, and 14½ feet from Seguine Point eastward across the shoal to the deep water in the outer bay.

The width of this shoal between the 21-foot curves was about 8,000 feet.

Through the middle of the bay, south of this channel from Great Beds Light directly toward Sandy Hook, only 11 feet of water could be carried over the shoals.

The above depths all refer to mean low water.

A survey of this bay was ordered in 1880, with the view of ascertaining the practicability of securing a greater depth of water from the main ship channel in the lower bay to the wharves at Perth Amboy, as vessels were often much delayed in crossing the shoal east of Seguine Point.

The estimated cost of dredging a channel 300 feet wide and 21 feet deep, mean low water, from Seguine Point southeastward to the deeper waters of the bay outside, was $126,500. (Annual Report Chief of Engineers, 1881, Part I, pp. 717–719.)

From March 3, 1881, to July 5, 1884, $120,000 was appropriated for this improvement, and a survey which was made in May, 1885, showed that the improved channel at that date had an average width of 250 feet, and a least depth of 18 to 20 feet mean low water.

The channel has slightly shoaled since the dredging was suspended in 1884. In 1885 the project was extended by providing for excavating a channel 300 feet wide and 21 feet deep, from Great Beds Light to deep water at Ward Point, opposite to Perth Amboy. This channel, taken in connection with its extension to the eastward of Seguine Point, would give a continuous 21-foot channel from the main ship channel in New York Bay to the wharves at Perth Amboy. The modified project of 1885 further called for dredging a channel from Great Beds Light to South Amboy, 4,500 feet long, 300 feet wide, and 15 feet deep, mean low water. The cost of dredging these two channels and restoring the original width in the cut east of Seguine Point was estimated at $114,000, which sum was increased in 1888 to $120,000, to provide for the shoaling which had taken place in the interval of three years. (Annual Report of the Chief of Engineers, 1885, Part I, p. 758.)

The appropriation, act of August 5, 1886, was $37,500, and was applied to completing the channel west of Ward Point, 300 feet wide and

21 feet deep, and in excavating a channel 315 feet wide and 21 feet deep across the crest of the shoal leading from the bend towards Seguine Point, but the funds were not sufficient to complete the whole of the projected work at that point.

It was stated in the original project of 1881 that the Seguine Point Channel would have to be maintained by dredging. The detailed survey, which was made in 1888 from the eastern end of Seguine Point Channel to Perth Amboy, showed that considerable shoaling had taken place, both in the improved channel and over a large stretch west of Princes Bay Light, where deep water formerly existed. This fact made it necessary in 1889 to submit revised estimates for the further improvement of the channels leading to Perth Amboy and to South Amboy. (Annual Report Chief of Engineers for 1889, Part I, p. 796.)

Revised estimates.

	Cubic yards.
(1) For a channel 300 feet wide and 21 feet, mean low water, from New York Lower Bay to Perth Amboy the following dredging will be required:	
(*a*) From 21-foot curve, New York Lower Bay, to 21-foot curve off Seguine Point	347,368
(*b*) From Princess Bay around Red Buoy 8 towards Great Beds Light	154,130
Total dredging	501,498
(2) For a channel 300 feet wide and 15 feet deep, from Great Beds Light to South Amboy, the dredging required will be	200,000

These estimates are made on the basis of an allowance of 1 foot overdepth, and for one-third increase in bulk for scow measurements.

Total dredging required for the completion of the two projected channels, cubic yards	701,498
Estimated cost of the proposed dredging	$175,375

The river and harbor act of August 11, 1888, appropriated $25,000 for continuing the improvement, and on the 27th of February, 1889, contract was made with James A. Simmons, of New York City, for the removal of 120,000 cubic yards of material from Raritan Bay; 80,000 cubic yards to be removed from the channel across the shoal off Seguine Point, securing 21 feet depth; and 40,000 cubic yards from the channel leading across shoal at Great Beds Light to South Amboy, securing 15 feet depth, mean low water.

The river and harbor act of September 19, 1890, appropriated $40,000 for continuing the improvement.

It may be noted in regard to this improvement that the deep-water channel which has been said to hug the south shore of Staten Island as far east as Seguine Point is the *ebb* channel, while the channel on the southern border of Round Shoal, through the center of the bay, heading on the line joining Seguine Point, north shore, and Conaskonk Point, south shore, is the *flood* channel. These two channels slightly overlap, passing each other at a distance of 7,000 feet.

The connection of these channels by an improved channel starting at Seguine Point and running southeast towards Sandy Hook is an unnatural connection, and it was stated in the original report in 1881 that the channel so projected would require annual dredging for its maintenance.

The experience of all the contracts which have been made for this improvement confirms the prediction of 1881. It would have been better, had sufficient funds been available in the beginning, to have extended the flood channel by dredging almost due west until it intersected the ebb channel a short distance to the eastward of the Great

Beds Light. Then the ebb and flood would have probably followed the same path, and there would have been a better prospect of having the the channel maintained by tidal scour.

The width of the intervening shoal is about 12,000 feet, and the average depth of water is 13 feet, approximately, between the 21-foot curves.

This will be the future channel which will connect the head of the Raritan Bay with the Amboys. A limited amount of dredging may be done annually in the Seguine Point Channel to maintain a 21-foot depth for vessels until commerce demands a more direct and convenient route across the shoal now lying at the western end of the bay.

The appropriation of $40,000, act of September 19, 1890, was applied towards the improvement of the Seguine Point Channel and the South Amboy Channel. The contract for the former was completed September 24, 1891, and the channel was then 180 feet wide and 21 feet deep, mean low water. The contract for the latter was completed July 8, 1891, and the channel was then 170 feet wide and 15 feet deep at mean low water.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1893.

No operations were in progress at the beginning of the fiscal year.

The river and harbor act of July 13, 1892, appropriated $40,000 for continuing the improvement, "one-half of which, in the discretion of the Secretary of War, may be used in dredging bar between South Amboy and Great Beds Light."

A project for the expenditure of this appropriation received the approval of the Secretary of War July 25, 1892; under this project proposals were invited by public advertisement, to be opened September 14, 1892, for dredging 105,000 cubic yards of material from the channel off Seguine Point, and 85,000 cubic yards of material from the channel leading to South Amboy. The bid of Thomas Potter, the lowest bidder, was accepted, and contract entered into with him October 6, 1892, at 17½ cents per cubic yard for material dredged from Seguine Point Channel and 21 cents per cubic yard for material dredged from channel leading to South Amboy.

Operations began under this contract October 26, 1892, on South Amboy Channel, and continued until December 24, when stormy whether and ice compelled their suspension. Work was again resumed on the same channel May 3, and completed May 13, 1892, at which date 81,831 cubic yards of material had been removed.

Work began on Seguine Point Channel May 22 with two clam-shell dredges, and at the close of the fiscal year 88,250 cubic yards had been removed under this contract.

At the close of the fiscal year the channel leading to South Amboy has been dredged to the full projected width of 300 feet and depth of 15 feet, mean low water. The improvement has been of material benefit to commerce.

The Seguine Point Channel has been dredged to a width of 250 feet and a depth of 21 feet, mean low water.

Both channels are subject to deterioration of deposits, the South Amboy Channel to a less degree than the Seguine Point Channel. Their maintenance, therefore, requires that frequent dredging should be done.

No complaint has been made by mariners during the year that the channels had either deficient width or depth.

The estimate of $95,000 recommended for the fiscal year ending June 30, 1895, will, if appropriated, complete the project of 1885, and if the improvement is to continue thereafter a new project and estimates will be required.

The amount expended during the fiscal year ending June 30, 1893, inclusive of outstanding liabilities, was $35,201.54.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Princes Bay. Nearest fort, at Sandy Hook, New Jersey.

Amounts appropriated.

Application.	Date.	Amount.
Dredging	Mar. 3, 1881	$50,000
Do	Aug. 2, 1882	50,000
Do	July 5, 1884	20,000
Do	Aug. 5, 1886	37,500
Do	Aug. 11, 1888	25,000
Do	Sept. 19, 1890	40,000
Do	July 13, 1892	40,000
Total		262,500

Amount expended to June 30, 1893, inclusive of outstanding liabilities, $256,405.58.

Money statement.

July 1, 1892, balance unexpended		$1,295.96
Amount appropriated by act approved July 13, 1892		40,000.00
		41,295.96
June 30, 1893, amount expended during fiscal year		20,107.45
July 1, 1893, balance unexpended		21,188.51
July 1, 1893, outstanding liabilities	$15,094.09	
July 1, 1893, amount covered by uncompleted contracts	2,931.24	
		18,025.33
July 1, 1893, balance available		3,163.18
Amount (estimated) required for completion of existing project		95,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		95,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for improving Raritan Bay, New Jersey, received in response to advertisement dated August 8, 1892, and opened September 14, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Dredging 105,000 cubic yards from Seguine Point Channel.		Dredging 83,000 cubic yards from South Amboy Channel.		Total.
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	
		Cents.		Cents.		
1	Atlantic Dredging Co	21½	$22,575.00	27	$22,410.00	$44,985.00
2	Thomas Potter	21⅝	22,968.75	26¼	21,787.50	*44,756.25
		17½	18,375.00	21	17,430.00	†35,805.00
3	Morris & Cumings Dredging Co	30	31,500.00	25	20,750.00	52,250.00

* If restricted to eight hours' work of plant per day.
† If not restricted to eight hours' work per day. Lowest bid.

COMMERCIAL STATISTICS.

The commercial statistics for the fiscal year ending June 30, 1890, have remained practically unchanged, and are therefore herein repeated,

The following statement of the commerce of South Amboy, N. J., and of Raritan River was prepared by Hon. D. C. Chase, mayor of South Amboy, N, J.:

Receipts and shipments.

	Tons.
Products of the forests	33,851
Products of quarries and mines	3,020,003
Animal products	16,541
Agriculture	37,557
Manufactures	417,909
Mechanical and miscellaneous	320,005
Total	3,845,866

Total value, $45,075,943.

Vessels arriving and departing.

Class.	Number.	Tonnage.	Draft (loaded).
			Feet.
Steamers	6,038	350,300	6 to 12
Barks	40	8,800	8 to 16
Brigs	40	8,800	8 to 16
Schooners	4,138	248,280	7 to 14
Sloops	1,002	52,210	5 to 7
Propellers	4,028	280,682	7½ to 10
Barges and lighters	45,838	2,887,794	7 to 16
Total	61,124	3,845,866	

The following statement of the commerce of Perth Amboy, N. J., for the year 1889 was received from Mr. James Donnelly, superintendent of the New Jersey division, Lehigh Valley Railroad Company:

Lehigh Valley Railroad tonnage eastward and westward over the wharves for the year 1889.

[Gross tons.]

	Received.	Shipped.	Total.
Coal piers.			
Coal		1,815,521	
Coke		3,058	
			1,818,579
Freight wharves.			
Grain		125,743	
Steel rails		34,052	
Pig iron	471	87,796	
Iron ore	86,194		
Lumber	33,207	875	
Fertilizers	106		
Clay		5,062	
Miscellaneous	5,867	7,732	
			387,705
United Refiners' Export Oil Company's Wharf.			
Oil		60,867	60,867
Grand total			2,267,151

Number, tonnage, and draft of vessels.

	Number.	Tonnage.	Draft.
Vessels transporting coal.			*Feet.*
Steam	102	500 to 3,000	
Sailing	848	50 to 1,200	
Barges	311	500 to 1,200	
Boats	4,821	100 to 400	
Vessels transporting freight.			
Ocean steamers	10	1,500 to 3,500	19 to 23.5
Sailing vessels	181	500 to 1,200	15 to 18
Lighters	57	200 to 500	6 to 12
Canal boats	1,238	200 to 300	6
Company's wharf.			
Barks and ships	59	500 to 1,500	15 to 18

E 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

(*1*) *Schooner Wild Pigeon.*—The schooner *Wild Pigeon* was sunk December 22, 1892, on the east side of Main Ship Channel, New York Harbor, about 1,500 feet eastward of Buoy C 4. The length of the schooner was 128 feet, beam 30 feet, depth 10 feet, and gross tonnage 387 tons. Her cargo consisted of 468 tons of soft coal.

Sealed proposals for the removal of the wreck were opened March 6, and with the approval of the Chief of Engineers the work was awarded to the Chapman Derrick and Wrecking Company, at a cost of $3,500. The wreck was practically removed by May 10 and deposited in deep water at sea, but payment has not been made for the service rendered since an examination shows that a small amount of wreckage projects above the bed at the site.

(*2*) *Canal boat in Bronx River.*—This wreck was an old canal boat that had been abandoned in the Bronx River by its owner, and had drifted into mid channel about one-half mile below West Farms. As the entire width of the river at that point is only 60 feet, it formed a serious obstruction to navigation above it.

Sealed proposals for the removal of the wreck were opened May 13, 1893, and the bid of L. M. Valentine, the lowest bidder, was accepted with the approval of the Chief of Engineers May 16, but on trial the bidder failed in his efforts to remove the wreck and declined to complete the work.

With the approval of the Chief of Engineers, May 29, the work was then awarded to Geo. McClintock, the next lowest bidder, and the wreck was successfully removed early in June, 1893, at a cost of $100.

Money statement.

March 1, 1893, allotment from appropriation for removing sunken vessels or craft obstructing or endangering navigation, act June 14, 1880; for removal of wreck of schooner *Wild Pigeon*, New York Harbor	$2,000.00	
March 4, 1893, additional allotment from same appropriation	1,600.00	
May 4, 1893, allotment from same appropriation for removal of wreck of canal boat, Bronx River	100.00	
		3,700.00
July 1, 1893, covered by agreements		3,600.00
July 1, 1893, balance available		100.00

E 14.

PRELIMINARY EXAMINATION OF FORT POND BAY, AT THE EAST END OF LONG ISLAND, NEW YORK.

[Printed in House Ex. Doc. No. 110, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report, dated November 9, 1892, with map,* by Lieut. Col. G. L. Gillespie, Corps of Engineers, of the results of a preliminary examination of Fort Pond Bay, at the east end of Long Island, New York, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Gillespie, concurred in by this office, that the locality is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., November 9, 1892.

GENERAL: I have the honor to submit the following report on a preliminary examination of Fort Pond Bay at the east end of Long Island, New York, in compliance with the requirements of the river and harbor act approved July 13, 1892.

The river and harbor act of August 11, 1888, made provision for a conditional survey of this bay, and the preliminary examination to ascertain whether the bay was worthy of improvement was assigned to Col. D. C. Houston, Corps of Engineers, copy of whose report may be found in the Annual Report of the Chief of Engineers, 1889, Part 1, p. 733–741.

The preliminary examination made by Col. Houston was complete and exhaustive, and it will be observed that the opinion is expressed in the report that "the harbor is not worthy of improvement in view of the present and prospective demands of commerce" (p. 736). There will be found appended to that report copies of letters received by Col. Houston from the agents of the leading transatlantic steamship lines, and also from the president of the Long Island Railroad Company, in reply to letters addressed to them asking their views relative to the worthiness of the improvement of Fort Pond Harbor.

Since the examination provided for by the act of July 13, 1892, was confided to me by letter from the Chief of Engineers, July 19, 1892, a personal inspection of the bay has been made and letters have again been addressed to the agents of the principal steamship lines and to the president of the Long Island Railroad Company, asking if anything has

* Not reprinted; printed in House Ex. Doc. No. 110, Fifty-second Congress, second session.

lately transpired affecting ocean navigation which would lead them to change the views expressed by them on the same subject in 1888. Copies of the replies to these inquiries are submitted, and attention is respectfully invited to them.

FORT POND BAY AND ITS APPROACHES.

Fort Pond Bay Harbor is a small and comparatively deep harbor lying on the north side of Long Island 6 miles, approximately, west of Montauk Point, the eastern extremity of Long Island, and is 124 miles distant from Long Island City, opposite East Thirty-fourth street, New York City, 96 miles of which are measured along the Long Island Railroad and 28 miles along a proposed eastward extension.

The description of the bay and its shores given by Lieut. James C. Sanford, Corps of Engineers, in his report to Col. Houston (p. 734) is so full and accurate in its details that it only remains to emphasize certain of the facts stated. The two shores are composed of a course grade of sand and gravel, through which large bowlders are interspersed. By the action of the elements the slopes have been gradually degraded, causing the coarse material to descend progressively to and into the waters of the bay, fringing both margins with wide layers of bowlders extending outward to the 25-foot curve at mean low water. The 10-foot curve is uniformly about 1,000 feet from each shore.

Beyond the 25-foot curve the bottom of the bay is composed of mud, 3 feet thick, overlying hard sand. Northward of Rocky Point, the western headland, large bowlders are quite prominent, which reach, as Coast Survey charts show, to the 35-foot curve at mean low water.

The bay measures a little less than 1 square mile, and the available area exterior to the 30-foot curve, mean low water, measures 420 acres. It is well sheltered, being open to storms from northeast round by westward to northwest only.

A small wharf, located on the east side near the head of the bay, is the only one in the harbor, but as there is no commerce there is no shipping to be served.

The act under which this report is submitted states in effect that the object had in view by a survey of the bay is the preparation of "an estimate of the cost of an adequate breakwater."

The absence of any commerce at this point, the isolation of the bay, and its separation from any of the usual incentives to trade, all indicate that the proposed breakwater is intended, not for the protection of any existing local commerce, but for the promotion of some other interest.

The only important scheme for utilizing the bay commercially of which I have any knowledge is the one mentioned in the public press frequently during the past four years, which refers to transatlantic service. It has been stated that the plan of the promoters of such a scheme is to shorten transatlantic travel by running a line of fast steamers between Milford Haven, Wales, and Fort Pond Bay, Long Island, connecting at the latter point with the Long Island Railroad for quick transit to New York City, and substituting at the New York end 124 miles of railroad travel for 100 miles of ocean travel.

As the expediency of the adoption of this proposed route partly depends upon the possibility of ocean steamers reaching or departing from Fort Pond Harbor day and night throughout the year, without

danger of serious detention, the physical character of the approaches is a proper subject of consideration.

It is not unreasonable to suppose that Long Island formerly extended eastwardly beyond its present limitations, and that its extreme eastern point, now Block Island, became detached by sea agencies assisted by land subsidence. The separating strait, 14 miles wide, has two shoal obstructions, which afford three passages from the ocean into Block Island Sound, with a maximum depth of 12 fathoms and a minimum depth of 4 fathoms at mean low water.

The western obstruction, called Phelps Ledge, lies 1¾ miles east of Montauk Point and has a least depth of 4 fathoms water, while the eastern, called Southwest Ledge, lies 4 miles west of Block Island, with a least depth of 5 fathoms water.

The water area north of the line connecting Montauk Point with Block Island and east of the entrance to Long Island Sound at the race is called Block Island Sound.

Block Island, lying on the south side of the eastern border of Block Island Sound, has a length of 6 miles north and south and an average width of 2 miles east and west, and the distance between the northern edge of the shoal reef, which extends out from the extreme northern point of the island, and Point Judith, Rhode Island, on the mainland, is 10 miles, approximately.

This last channel is entirely free from obstruction, and has a maximum depth in the center of 22 fathoms, diminishing toward the two shores to 4 fathoms.

Block Island Sound must be entered and crossed by vessels making Fort Pond Bay from the sea. In clear weather it is probable that it would be habitually entered to the westward of Block Island, but in thick weather it would doubtless be safer to enter the sound to the eastward of the island.

The point of divergence from the main ocean route would be in the vicinity of Nantucket Shoals Light-ship, and the distance thence to Fort Pond Bay, whether by the eastward or westward of Block Island, would be 100 miles, approximately, and to the bar at Sandy Hook 180 miles, approximately.

The submerged obstructions which lie in the strait between Block Island and Montauk Point, and in Block Island Sound north of Shagwong Point, Long Island, may be easily discerned in clear weather, as they are marked by the usual aids to navigation, but in thick weather, when the islands and headlands are enveloped in dense banks of fog, navigation into Block Island Sound from the southward must necessarily be attended with many apprehensions, however numerous and perfect the fog signals may be, as not only must headlands and submerged reefs be avoided, but also small vessels, which largely frequent these waters for anchorage. These conditions affect the speed of vessels approaching Fort Pond Bay, if they do not menace the lives of passengers and endanger property, and will not be materially changed so long as fog prevails on the coast.

APPROACH TO NEW YORK CITY BY SANDY HOOK.

It has been alleged, among other reasons, that Fort Pond Bay should be improved by the General Government in the interest of rapid ocean transit, because there is not adequate water on the Sandy Hook Bar to accommodate modern vessels and steamers of large size and deep draft,

and because fog prevails more at Sandy Hook than at Montauk Point. These charges will bear close examination.

(1) Since 1886 the deepening of the main ship channels through the lower bay, New York Harbor, has so far advanced that the depth of water on the bar at the southern entrance, by way of Gedney Channel, is to-day greater than 30 feet at mean low water, which is more than sufficient for any vessel or steamer afloat. In addition, Gedney Channel is clearly marked at night by an efficient system of electric lights, enabling vessels of any draft to pass in and out over the bar at night at any stage of the tide with nearly the same facility as in daylight, thereby destroying the terrors to mariners which have been ascribed to this channel and its bar.

The annual report of the Light-House Board to the Secretary of the Treasury for 1891, p. 201, referring to Sandy Hook Bar, says:

> The monthly report of vessels passing the bar at night records as coming in the largest steamers plying to the port of New York, such as the *Etruria, City of Paris, Majestic, Fürst Bismarck, Umbria, La Champagne, Lahn, La Bourgogne, Germanic, Ems, Augusta Victoria, Teutonic*, etc.
>
> The *City of Paris* and *City of New York* are of 10,500 tons' register and the *Teutonic* and *Majestic* of 10,000 tons.
>
> By a coincidence the *Teutonic* seems to arrive off Sandy Hook at night, as by the known record she has *passed the bar at night coming in some six times.*

And on pages 205 and 206 of the same report it is stated that the number of vessels using Gedney Cut Channel (improved channel) between sunset and sunrise, for the fiscal year July 1, 1889, to June 30, 1890, was 569, 377 bound in and 192 bound out, and that the number for the fiscal year July 1, 1890, to June 30, 1891, was 767 vessels, 470 bound in and 297 bound out.

Unpublished reports to which I have had access record that during the year 1891–'92, 785 vessels and steamers crossed the bar at night, 533 bound in and 252 bound out.

It is further stated in the report of 1891, p. 201, that—

> The highest [monthly] work done by electric plant since its establishment was in November, 1890, when 101 vessels passed the bar, 67 coming in and 34 going out, or an average of 3.4 vessels each night.
>
> The best test of the plant is shown by the confidence with which pilots bring in from sea vessels of the largest displacement and length.

These records plainly show that the Sandy Hook Bar does not now cause detentions to vessels, day or night, on account of insufficient depth of water.

(2) Respecting the allegation that fog prevails more at Sandy Hook than in the vicinity of Montauk Point it must be admitted that the Government records for a series of years of the relative number of hours during which the fog signals have been operated, annually, at Sandy Hook and at Montauk Point, show, apparently, to the advantage of Montauk Point, but the difference is very slight, and too much importance should not be given to the records, for in the case of Sandy Hook the signals are required to be given so long as the lightship in advance of Gedney Channel Bar is obscured by fog, whereas at Montauk Point the keeper exercises his own discretion when to operate the signal.

In addition, pilots, familiar with the two localities by constant cruising in adjacent waters, have been questioned on the subject, and the general opinion is that fogs are more frequent and more dense at the eastern than at the western end of Long Island.

I am of the opinion that the usual conditions in regard to fogs differ inappreciably at those two points, and that all things considered it is reasonable to estimate that the time consumed in making Fort Pond

E 15.

PRELIMINARY EXAMINATION FOR CHANNEL WEST OF ROBBINS REEF LIGHT-HOUSE TO CONNECT THE MOUTH OF ARTHUR KILL WITH NEW YORK HARBOR, NEW YORK.

[Printed in House Ex. Doc. No. 77, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated August 1, 1892, by Lieut. Col. G. L. Gillespie, Corps of Engineers, of the results of preliminary examination for channel west of Robbins Reef light-house to connect the mouth of Arthur Kill with New York Harbor, New York, made to comply with the provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Lieut. Col. Gillespie, concurred in by this office, that the proposed channel is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF LIEUT. COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, August 1, 1892.

GENERAL: In compliance with instructions contained in letter of Chief of Engineers, dated July 14, 1892, I have the honor to submit the following report in regard to preliminary examination, "for channel west of Robbins Reef light-house, to connect the mouth of Arthur Kill with New York Harbor, New York," for which provision is contained in section 6, river and harbor act July 13, 1892.

For many years the towing companies interested in the navigation between the Raritan and Passaic rivers, and New York Harbor through Kill van Kull, have made efforts to secure appropriation from Congress for opening a short and sheltered interior channel across Jersey Flats. The river and harbor act March 3, 1881, provided for the survey of such a channel, 21 feet deep, mean low water, from Communipaw to Constable Hook, and the report thereon (Annual Report Chief of Engineers, 1882, Part I, p. 719) gives the estimated cost of the work, $7,000,000, the great cost being due to a reef of rock underlying the shoal to the eastward of Cavens Point.

The channel now proposed to be surveyed is not definitely located by the act of July 13, 1892, but as I have before me a copy of the map accompanying the petition which was sent to Congress urging the survey, I am able to describe it very accurately. The wish of the projectors, as stated in their petition, is anchorage for vessels and tows on the southern edge of the flats immediately to the eastward of Constable Point, 2,000 feet wide, 2,500 feet long, and 15 feet deep, mean low water, from which a channel 300 feet wide and 15 feet deep shall lead in a

On the 13th of December, 1888, and again on the 17th day of June, 1890, I addressed communications to the commissioners of the sinking fund, which were referred to the comptroller for examination and report. (See Proceedings of Sinking Fund Commissioners for 1890, pp. 441-2-3.)

On September 17, 1890, the comptroller, the Hon. Theodore W. Myers, made an able and elaborate report to the commissioners of the sinking fund upon the subject-matter of the communications above referred to, advocating the advantages of having the dumping ground for the city's dirt, ashes, and sweepings at Rikers Island, instead of in the bay or off the mouth of our noble harbor. (See Proceedings of the Commissioners of the Sinking Fund, September 18, 1890, pp. 476-479.)

On December 23, 1890, the New York harbor line board, appointed by the Secretary of War, for the establishment of the harbor lines of the harbor of New York and its adjacent waters, by Special Orders, No. 49, Headquarters Corps of Engineers, U. S. Army, Washington, D. C., October 5, 1888, in accordance with section 12 of act of August 11, 1888, having had under consideration the limitation of the pier and bulkhead lines around Rikers Island, and no one appearing on behalf of the city of New York, to advocate the establishment of the harbor line upon the 12-foot contour line, around said island, or even to inform the board that the State of New York had given the city of New York the right to establish and build its bulkheads on said 12-foot contour line the harbor line board naturally established the line in accordance with the act of assembly of 1857, which limited the entire area of land under water that could be filled in to about 54 acres, or less than one-eighth in territorial extent of the land claimed by the city of New York under grant from the State by the act of the legislature of June 9, 1885.

As a citizen of New York, for myself, as well as for my clients, I have the honor to request that you will order the harbor line board to reconsider its action of December 23, 1890, to enable the officials of the city of New York to lay the above, and such other facts, before the board, for its consideration and action, as will be conducive to the best interests of the United States Government, as well as to the city of New York.

It is a well-known fact that over 1,500,000 cubic yards of cellar dirt, street sweepings, ashes, and débris of old buildings, exclusive of garbage, are annually collected in this city and carried away in self-dumping and other scows and dumped into the bay or off the mouth of the harbor, greatly to its injury, as well as endangering the health of seaside resorts, viz: Manhattan Beach, Coney Island, Rockaway Beach, Arverne, and other resorts on the southern shore of Long Island, as well as the resorts on the New Jersey coast from Sandy Hook to Seabright, Monmouth Beach, Long Branch, Deal Beach, Asbury Park, and Ocean Grove, to say nothing of fouling the shores of the lower bay, and injuring the entire harbor of New York, and compelling additional dredging by the United States Government every year to keep the harbor accessible to commerce.

If the harbor line board should be authorized by you to reconsider its former action, and should decide to adopt the 12-foot contour line around Rikers Island, your and their action would be most heartily applauded, not only by all our city officials, but by the citizens of New York en masse.

The towage of scows to Rikers Island, up East River, would be, on an average, about 12 miles as against a claimed towage seaward of about 25 miles. This first saving per annum in towage alone would

bor lines is essential to the preservation and protection of harbors, he may and he is hereby authorized to cause such lines to be established, beyond which no piers or wharfs shall be extended or deposits made except under such regulations as may be prescribed from time to time by him."

Pursuant to the provisions of that act, the Secretary of War referred it to a board of United States engineers, known as "The Harbor Line Board," who recommended to him the adoption of the same line that was fixed by the act of 1857 as the harbor line in front of the premises in question, which recommendation was adopted and approved by the Secretary of War on February 8 and March 4, 1890.*

That it was the intention of the Harbor Line Board, appointed by the Secretary of War, to conform to the State line is established by a letter signed by Gen. Henry L. Abbott, dated September 14, 1892, addressed to the board of commissioners of pilots of the port of New York, in which he says:

> The established harbor lines in this locality are identical with those determined by the State authorities in 1857, and on the original map now on file in this office no wharfs extend beyond the established limits.
> Recent surveys show that certain wharves extend beyond these limits.

Upon such surveys being made, notice was sent to the board of commissioners of pilots, requiring them, as part of their duties conferred upon them by the State law, to cause these encroachments to be removed, and a notice was sent to the following persons, representing all the pier owners between Harris avenue, in Long Island City, and Pierce avenue, in the same city, to remove the said obstructions.

From a map made by the Board of Engineers for the said Harbor Line Board it would appear that these piers, five in number, encroached a distance of from 15 to 40 feet beyond the established line. In behalf of the New York Architectural Terra Cotta Works, the estate of B. T. Babbitt, the W. J. Mathison Company, limited, and the John Good Rope and Cordage Company, four of the said pier owners, and also in behalf of the East River Gas Company, who is about to erect a pier or bulkhead in front of their premises, we respectfully ask the Secretary of War to reconsider his determination as to the location of the said line, and fix a line which shall include within its limits the piers as now constructed; or, if it seems to him more desirable to do so, to refer the matter back to the Harbor Line Board, with instructions to them to reconsider their action, and if such line can be extended without prejudicing the interests of commerce and navigation, to report the matter back to the Secretary of War for his further action in the premises.

The fifth pier owner who encroaches is the municipality of Long Island City, who has a small pier or bulkhead about 20 feet wide at the foot of Webster avenue, of little value, and for that reason they have taken no interest in this application. The grounds upon which this application is based are as follows:

At the time that the act of 1857 was passed the entire neighborhood was unsettled and remote from any centers of trade or commerce or from any thickly-settled portion of either the cities of New York or Brooklyn. The premises in question lie directly opposite Blackwells Island, now used by the municipality of New York for penitentiary purposes, and the whole of the land in question but a short time before the passage of said act had been used by the city of New York for

* See Annual Report, Chief of Engineers, 1890, pp. 791 and 810.

The next pier against which complaint is made is the pier of the W. J. Mathison Company, Limited, who are extensively engaged in the manufacture of dyestuffs. These premises were purchased by Mr. Mathison, the president of the said company, in March, 1887, and in the subsequent October he applied for and obtained from the people of the State of New York letters patent for the land under water in front of his upland out to the said State line of 1857. Subsequently he built a dock similar in its construction to the dock of the Babbitt estate, upon which there is erected immediately against the stringpiece of said dock or bulkhead a building 40 feet wide, fronting upon the river, 80 feet deep, and 20 feet high, adjoining which there is a coal elevator, likewise upon the edge of the wharf or bulkhead, used in carrying on the said business, and adjoining that and occupying the rest of the water front of said premises there is a system of water pipes connecting with the river, supplying their factory with water used in the purposes of their business.

At the time that this dock was constructed they likewise caused a survey of their premises to be made, and in good faith erected the same, supposing that their structure was wholly within the line fixed by the State and subsequently adopted by the Federal authorities.

The next pier or bulkhead as to which complaint is made is the pier or bulkhead belonging to the John Good Cordage Company, who are carrying on an extensive business in the manufacture of cordage, rope, and rope-making machinery on the premises in question. The upland was conveyed to Mr. John Good, the president of the said company, in April, 1886, and thereafter, and on February 9, 1887, he applied for and obtained from the people of the State of New York letters patent granting to him the land under water in front of his said premises out to the State line of 1857. The dock in front of the said premises was constructed about the time of the purchase of said land by Mr. Good, and is similar in its construction to the other docks or bulkheads hereinbefore referred to. Upon the said bulkhead and 19 feet distant from the stringpiece, there is a building 60 feet long parallel with the said stringpiece, which is now filled with valuable machinery used in the carrying on of the said business. At the time this dock was constructed they likewise had a survey made, and in good faith constructed the said dock, believing it to be wholly within the lines hereinbefore referred to.

The East River Gas Company, the other petitioner herein, is a corporation who is about erecting a large and valuable plant between the land of the John Good Cordage Company and the land of the W. J. Mathison Company, for the purpose of manufacturing and delivering gas in large quantities to the adjoining cities of New York and Brooklyn, and they have prepared their plans for the erection of a dock upon the line as they have supposed it to exist and are anxious to construct the same at once. None of the parties above referred to supposed that they had encroached beyond the line established by law until about one month ago, when notice was received by each of them from the Board of Commissioners of Pilots of the port of New York to the effect that their bulkheads encroached beyond said lines, and asking them to remove the said encroachments.

The parties immediately procured a new survey to be made, showing the land to which each of them was entitled under their respective deeds and letters patent from the people of the State of New York, and also the actual location of the piers and bulkheads as they are at present constructed.

An additional reason for asserting that the interests of commerce and navigation will not suffer is founded on the fact that no complaint has been made by any navigator on account of said bulkheads, as has been stated to the petitioners or their representatives by the secretary of the board of pilot commissioners.

Additional evidence can be presented upon this point, and also upon the point of the general shallowness of the waters in the immediate neighborhood of these piers, if the Secretary desires to receive the same.

In other cases, and notably in the case of the pier line on the East River, between Broadway and Newtown Creek in the city of Brooklyn, the Secretary of War has reconsidered his original determination and has fixed another line in the interests of manufactures established in good faith and without knowledge that they had trespassed beyond the line established by law.

JOS. A. BURR, Jr.,
Counsel for the Petitioners.

THE NEW YORK ARCHITECTURAL TERRA COTTA COMPANY.
THE ESTATE OF B. T. BABBITT.
THE W. J. MATHISON COMPANY, LIMITED.
THE EAST RIVER GAS COMPANY.
THE JOHN GOOD CORDAGE COMPANY.

WAR DEPARTMENT, *December 15, 1892.*

Referred to the Chief of Engineers for report.

S. B. ELKINS,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 15, 1892.

Respectfully referred to the harbor line board for New York Harbor and its adjacent waters for report.

To be returned.

By command of Brig. Gen. Casey:

H. M. ADAMS,
Major, Corps of Engineers.

REPORT OF BOARD OF ENGINEERS.

HARBOR LINE BOARD,
New York City, January 16, 1893.

GENERAL: The harbor line board for New York Harbor and its adjacent waters, constituted by Special Orders No. 49, Headquarters Corps of Engineers, October 5, 1888, to comply with section 12 of the river and harbor act of August 11, 1888, has had under consideration the application (December, 1892) of Joseph A. Burr, jr., counsel for certain "property owners on the east shore of the East River at Ravenswood, Queens County, N. Y., for the reconsideration of the order (Secretary of War March 4, 1890) fixing the pierhead and bulkhead lines."

The papers in the case were forwarded for the action of the board by your indorsement of December 15, 1892.

A public hearing was had in this case January 16, 1893, notice of which had been given by advertisement and by circular letters to parties in interest. Mr. Burr, counsel for the petitioners, was present and made a verbal statement to the board of the special reasons why the application was made, which reasons, stated briefly, are that the extension of the piers of the petitioners beyond the lines established by the State in 1857 was made in ignorance of the exact limitations of those lines, and that the removal now of the offending pierheads would subject the petitioners to severe and unnecessary damage.

The water front upon which the property of the petitioners lies embraces that part of the east shore of the eastern channel at Blackwells Island which extends from Robertson street eastward to and beyond the "cofferdam" for railroad abutment near Graham avenue in the town of Ravenswood.

On September 1, 1892, there was referred to the board for consideration an application by Mr. H. H. Wotherspoon, of Ravenswood, N. Y., asking that the legal harbor lines on his front be extended outward to the extreme end of his pier, so as to legalize that construction. As the construction referred to was a local and isolated projection beyond long-established harbor lines, the board did not deem it expedient to recommend any modification in those lines. The board believes, from the papers before it, that the encroachments built upon the eastern channel prior to 1890, as recited by the petitioners, were made ignorantly and without willful violation of State law, and that the petitioners are entitled to a considerate hearing.

The lines recommended by the board in its original report, dated February 18, 1890, were intended to be those previously established by the State act in 1857. These lines were laid out upon unoccupied shore, and no attempt was made by the State act to define them by exact description or to establish their exact location by reference to an illustrative map showing offsets drawn from fixed base lines.

These omissions opened the way for errors in the subsequent establishing of lines upon separate fronts, especially as the law provided no particular surveyor whose duty it should be to make surveys with the view of locating the outer ends of piers on application of riparian owners.

The board is of the opinion that the rigorous adherence now to the State lines of 1857, reëstablished by the United States in 1890, requiring the cutting off of these encroaching parts of existing piers, will occasion great expense to riparian owners.

The board has disapproved modifications of existing lines at other places when it was manifest that by so doing navigable waters would be seriously threatened, but in the present instance the board, after a careful hearing of the petitioners, is of the opinion that the riparian owners have reasonable grounds for their application.

In view, therefore, of the foregoing statements in regard to the imperfections of the charts upon which the original State lines of 1857 were delineated, leading to subsequent inaccurate location of piers at different times by different surveyors, without provision for adequate supervision, and in view also of the probable removal of the outlying shoal by riparian holders for the efficient occupancy of their water fronts, the board recommends that the pierhead and bulkhead lines from Robertson street to Graham avenue at Ravenswood be extended outwards so as to embrace the pierheads of all piers now built upon that front.

The modifications which are recommended may be described as follows:

Beginning at a point in the pier and bulkhead line approved by the Secretary of War February 8, 1890, in the westerly extension of the north side of Robertson street 500 feet from the westerly side of Vernon avenue; thence in a straight line to a point in the westerly extension of the north side of Babbitt street, 530 feet from the west side of Vernon avenue; thence in a straight line to a point in the westerly extension of the north side of Noble street, 656 feet from the west side of Vernon avenue; thence in a straight line to a point in the westerly extension of the north side of Webster avenue, 690 feet from the west side of Vernon avenue; thence in a straight line to a point in the westerly extension of the south side of Pierce avenue, 625 feet from the west side of Vernon avenue; thence in a straight line to a point in the extension of the north side of Graham avenue, 505 feet from the west side of Vernon avenue; thence in a curve for the distance of about 400 feet until it meets the pier and bulkhead line approved by the Secretary of War March 4, 1890.

The modification of the lines herein recommended are shown upon an accompanying tracing.*

A separate map* is sent showing the relations which the new lines will bear to those established by the Secretary of War March 4, 1890.

Respectfully submitted.

WM. P. CRAIGHILL,
Colonel, Corps of Engineers.
C. B. COMSTOCK,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.
D. C. HOUSTON,
Colonel of Engineers.
G. L. GILLESPIE,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 24, 1893.

Respectfully submitted to the Secretary of War.

The harbor line board for New York Harbor and adjacent waters, having had under consideration the subject of harbor lines on the east shore of East River at Ravenswood, N. Y., submits the within report, recommending the adoption of modified harbor lines at that locality as shown on the accompanying tracing.

It is recommended that the views of the board and the modified lines suggested be approved and that the Secretary place his approval both upon this report and the accompanying tracing.

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

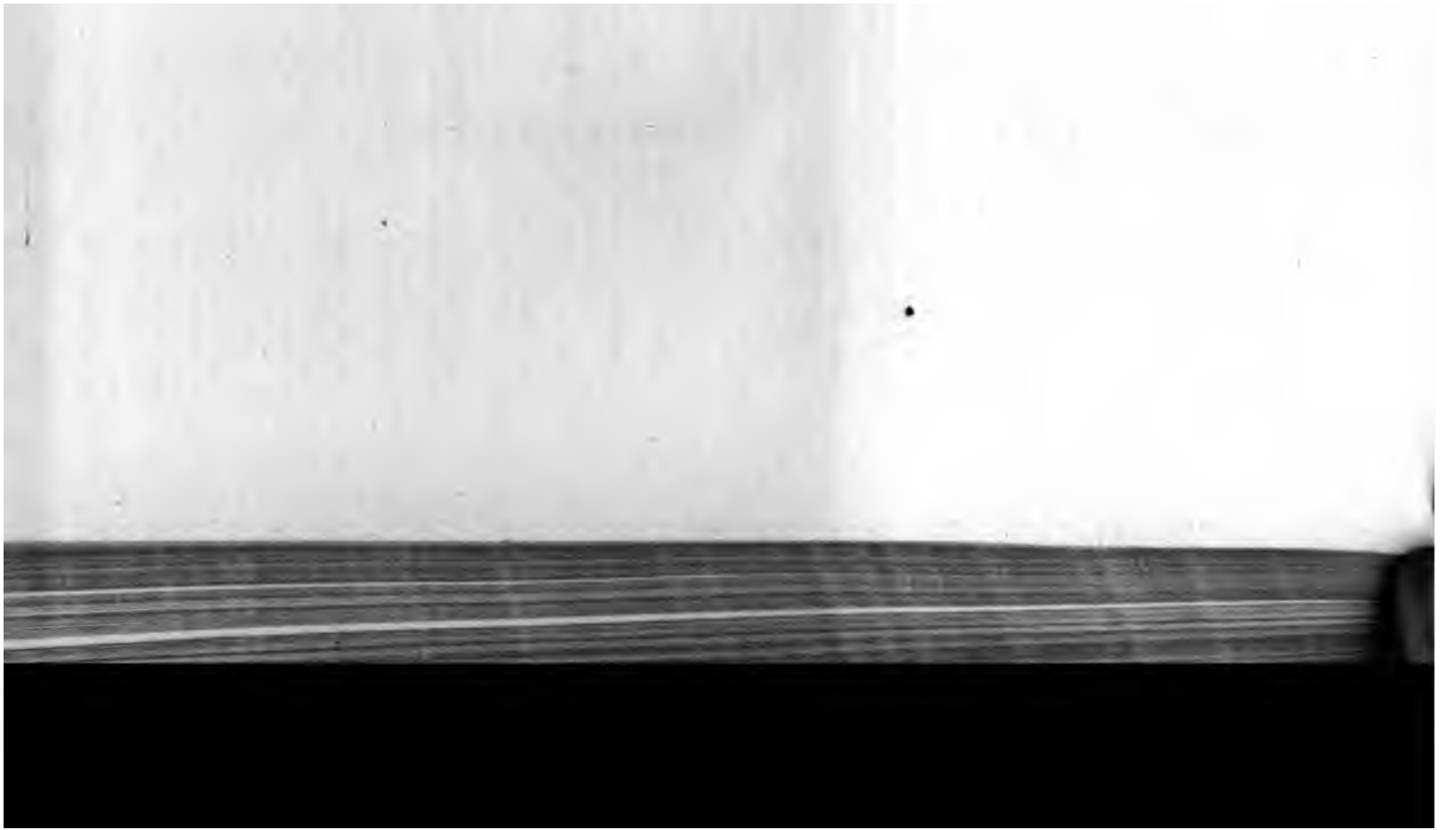
[Second indorsement.]

WAR DEPARTMENT, *June 1, 1893.*

The modification in the pierhead and bulkhead lines, recommended by the New York harbor line board in the within report and indicated in a full black line on the accompanying tracing, is approved.

DANIEL S. LAMONT,
Secretary of War.

* Omitted.



APPENDIX F.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHWESTERN PART OF LONG ISLAND AND NEAR STATEN ISLAND, NEW YORK, AND IN NORTHEASTERN NEW JERSEY.

REPORT OF CAPT. THOMAS L. CASEY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Sumpawanus Inlet, New York.
2. Canarsie Bay, New York.
3. Sheepshead Bay, New York.
4. Arthur Kill, New York and New Jersey.
5. Channel between Staten Island and New Jersey.
6. Passaic River, New Jersey.
7. Elizabeth River, New Jersey.
8. Rahway River, New Jersey.
9. Raritan River, New Jersey.
10. South River, New Jersey.
11. Keyport Harbor, New Jersey.
12. Mattawan Creek, New Jersey.
13. Shoal Harbor and Compton Creek, New Jersey.
14. Shrewsbury River, New Jersey.
15. Manasquan (Squan) River, New Jersey.

EXAMINATIONS.

16. Seaford Creek, Long Island, N. Y.
17. Channel connecting Freeport with Great South Bay, New York.
18. Whale Creek, New Jersey.

UNITED STATES ENGINEER OFFICE,
New York, July 10, 1893.

GENERAL: I have the honor to transmit herewith my annual report on the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1893.

Very respectfully, your obedient servant,

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

F 1.

IMPROVEMENT OF SUMPAWANUS INLET, NEW YORK.

Sumpawanus Inlet, known in the neighborhood and on the Coast Survey charts as Sumpawams Creek, is a small creek on the south side Long Island, emptying into the Great South Bay. It lies about 36 miles east of New York City, 15 miles east of the western end of Great South Bay, and nearly twice as far from its eastern end.

The project of improvement provides for dredging a channel 150 feet wide and 5 feet deep at mean low water from the 5-foot curve in the bay to the steamboat dock at the mouth of the creek, a distance of about 1,500 feet, and thence 5 feet deep and 100 feet wide up the inlet to the town of Babylon, a distance of about 3,500 feet farther. The estimated cost of making this improvement is $23,115.

Of this amount $7,000 has been appropriated, the last allotment being included in the act of August 2, 1882.

Ten thousand dollars can be expended in giving a 5-foot channel out into the bay for the use of steamboats, but I think that the work is more a matter of local than public interest.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fire Island Light; nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1893, was $138,032,031.18.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
March 3, 1881	$5,000
August 2, 1882	2,000
Total	7,000
Amount expended	7,000

Money statement.

Amount (estimated) required for completion of existing project	$16,115.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Sumpawanus Inlet, New York, during the year ending December 31, 1892, were kindly furnished by Hon. James B. Cooper, justice of the peace, Babylon, L. I.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average Tonnage.
	Tons.				*Feet.*	*Tons.*
Oysters and clams	80	$30,000	Steam ..	8	4½	90
Fish	320	38,400	Sail	350	3	12
Building material	1,000	20,000				
Miscellaneous	20	2,000				
Total	1,420	90,400		358		

This table shows a decrease of 7 tons when compared with that given for calendar year 1891.

F 2.

IMPROVEMENT OF CANARSIE BAY, NEW YORK.

The first survey of this bay with a view to its improvement was made in 1879. The scheme of improvement involved a channel 6 feet deep at mean low water and 100 to 150 feet wide, extending from the shore at Canarsie Landing to the navigable channel in Jamaica Bay, a distance of about 3,500 feet. It was thought that the channel might be maintained by the construction of two pile dikes, forming a tidal reservoir. The estimated cost under this project was $88,000. A history of the work in considerable detail is given in the Annual Report of the Chief of Engineers for 1887, Part I, p. 637.

The total amount expended on this improvement to June 30, 1892, was $47,944.13, with which two pile dikes had been built and maintained on the north and south sides of the channel at its entrance into Jamaica Bay, 1,058 and 820 feet long, respectively, and the channel dredged to a depth of 6 feet at mean low water and width of about 125 feet from Canarsie Landing to the deep water of the bay. In addition to this several other improvements not contemplated in the main project, but which added materially to the facility of navigation or to the maintenance of the channel, had been executed, viz., the excavation of a cut 100 feet long and 50 feet wide, with a depth of 6 feet, on the east side of the steamboat landing at Canarsie, and a cut at the end of the wharf at Canarsie Landing extending through to the southwest to connect with the southwest channel, the latter for the purpose of promoting tidal circulation. The tidal currents are due to a mean rise and fall of 4.7 feet.

The river and harbor act of July 13, 1892, appropriated $5,000 for continuing this improvement and a project for its expenditure, in dredging the channels in the harbor to the required depths and widths, was approved August 11, 1892, the work to be done by contract after advertisement and award in accordance with regulations. Specifications were prepared and sealed proposals invited by advertisement February 18, 1893, for widening and deepening the main channel and the channel west of the steamboat dock at Canarsie, connecting with the southwest channel, the former to a width of 150 feet and mean low-water depth of 6 feet, and the latter to a width of 60 feet with a mean low-water depth of 4 feet. Bids were opened March 29, 1893, the lowest aggregate bid being that of J. H. Fenner, of Jersey City, N. J., at 24 cents per cubic yard for material removed from main channel, and 40 cents per cubic yard for the west channel (abstract herewith). This bid was approved and a contract entered into April 15, 1893. Work under this contract was begun May 23, 1893, and was in progress at the close of the fiscal year, 7,867 cubic yards having been removed.

The expenditures during the fiscal year amount to $591.75, as follows:

Inspection	$126.67
Drafting	150.00
Administration	315.08
Total	591.75

Canarsie Landing, besides being the terminus of the Brooklyn, Rockaway Beach and Jamaica Bay Railroad, from which passengers are transshipped by steamer to Rockaway Beach, has a large fishing industry.

It is thought that $10,000 will be sufficient to complete the channel and keep the dikes in repair, and an appropriation of this amount is therefore recommended.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fort Tompkins Light; nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1893, was $138,032,031.18.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
June 14, 1880	$10,000.00
March 3, 1881	5,000.00
August 2, 1882	3,000.00
July 5, 1884	5,000.00
August 5, 1886	10,000.00
August 11, 1888	10,000.00
September, 19, 1890	5,000.00
July 13, 1892	5,000.00
Total	53,000.00
Amount expended	48,535.88

Money statement.

July 1, 1892, balance unexpended		$55.87
Amount appropriated by act approved July 13, 1892		5,000.00
		5,055.87
June 30, 1893, amount expended during fiscal year		591.75
July 1, 1893, balance unexpended		4,464.12
July 1, 1893, outstanding liabilities	$2,649.37	
July 1, 1893, amount covered by uncompleted contracts	1,350.63	
		4,000.00
July 1, 1893, balance available		464.12
Amount (estimated) required for completion of existing project		35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895		10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		

Abstract of bids for improving Canarsie Bay, New York, by dredging, received and opened March 29, 1893, under advertisement dated February 18, 1893.

Name and address of bidder.	Rate per cubic yard.		Amount available for dredging.	Amount that can be removed with available funds.
	Main channel.	West channel.		
	Cents.	*Cents.*		*Cubic yards.*
Elijah Brainard, New York, N. Y	23½	58½	$4,000	6,809 to 17,021
J. H. Fenner, * Jersey City, N. J	24	40	4,000	10,000 to 16,667
P. Sandford Ross, Jersey City, N, J	26	65	4,000	6,154 to 15,385

* Contract entered into April 15, 1893.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Canarsie Bay, New York, during the year ending June 30, 1892, were kindly furnished by Mr. William Warner, superintendent of the Brooklyn, Rockaway Beach and Jamaica Bay Railroad.

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Fish	3,010	$215,000	Steam	6	5½	300
Coal	4,500	15,000	Sail.....	75	5½	16
Fertilizers	43,000	43,000	Yachts ...	100	3½	4
Oysters and clams	17,000	35,000				
Total	67,510	308,000		181		

The above table shows an increase of 11,300 tons over that reported for calendar year 1891.

F 3.

IMPROVEMENT OF SHEEPSHEAD BAY, NEW YORK.

Sheepshead Bay, Long Island, is a small tidal bay about 2 miles long, lying inside Coney Island, New York, and extending easterly from the village of Gravesend to Rockaway Inlet, into which it empties. Its width varies from 100 to 1,000 feet, and its depth from 0 to 10 feet at mean low water. The natural entrance is subject to progressive changes of position, due to the action of the waves on the sandy beaches.

The original project for the formation and maintenance of a dredged channel 100 feet wide and 6 feet deep, mean low water, was modified in February, 1889, the modified project contemplating a channel 5,350 feet long, 60 feet wide, and 5½ feet deep, mean low water, from the town of Sheepshead to within 1,080 feet of Dead Horse Inlet Cut, to connect with the channel of similar width and depth already existing at that point. This channel, which was completed December 6, 1889, seems to have maintained itself in a very satisfactory manner.

Sheepshead Bay is a harbor of minor importance, and must so continue until the entrance can be improved by an expensive system of jetties. At present it is for the most part used as a haven for small oyster and clam boats and for a large fleet of pleasure boats in the summer season. The utility of future appropriations must be judged of, therefore, by these facts.

The commerce of the bay was reported for the year 1892 to be 132,200 tons, valued at $3,598,000, as against 106,600 tons, valued at $2,380,000, for 1890.

The expenditures for the fiscal year ending June 30, 1893, amount to $116.02, for office expenses.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Fort Tompkins Light; nearest fort, Fort Hamilton.

The amount of revenue collected at the port of New York during the fiscal year ending June 30, 1893, is $138,032,031.18.

Original estimate (1879) $100,000.00
Revised estimate (1882) 34,200.00

AMOUNTS APPROPRIATED.

By act of Congress approved—	
June 14, 1880	$3,000.00
March 3, 1881	5,000.00
August 2, 1882	3,000.00
July 5, 1884	5,000.00
August 5, 1886	5,000.00
August 11, 1888	5,000.00
Total	26,000.00
Amount expended	25,943.45

Money statement.

July 1, 1892, balance unexpended	$172.57
June 30, 1893, amount expended during fiscal year	116.02
July 1, 1893, balance unexpended	56.55
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	8,200.00

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Sheepshead Bay, New York, during the year ending December 31, 1892, were furnished by Mr. John Y. McKane, of Sheepshead Bay, New York.

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Building material, pipe, blue stone, flagging, and coal.	96,600	$2,898,000	Steam	400	5	100
			Sail	600	3	25
			Barges	125	5½	250
Fish, clams, etc	35,600	700,000	Rafts	75		
Total	132,200	3,598,000		1,200		

The above table shows an increase in the commerce of 25,600 tons over that reported for calendar year 1890.

F 4.

IMPROVEMENT OF ARTHUR KILL, NEW YORK AND NEW JERSEY.

A history of this improvement, which originated by special resolution of the Committee of Commerce in the Senate, is given in the Annual Report of the Chief of Engineers for 1889, Part I, p. 819, and a further statement of the condemnation proceedings necessary for the acquirement of the land forming Steep Point is given in my Annual Report for 1890, p. 843. The approved project provides for the removal of this point of land by successive parallel cuts to the regular channel depth, with the object of rectifying the current near the Baltimore and Ohio Railroad Bridge. It is estimated to cost $26,500.

Up to June 30, 1892, $16,245.59 had been expended in acquiring the land and in dredging off about one acre of the point, increasing the

width of the channel by 210 feet, and, as observation shows, in directing the currents more nearly perpendicular to the bridge.

The river and harbor act of July 13, 1892, appropriated $5,000 for the continuance of this improvement, and a project for its expenditure was approved July 29, 1892.

Specifications were prepared and sealed proposals invited by advertisement, August 9, 1892, for the removal of the land in question by dredging to a depth of 13 feet at mean low water, where the depth is now from + 6 feet to — 13 feet at the same stage of the tide. Bids were opened September 15, 1892, the lowest bidder being the Atlantic Dredging Company, of New York, at 24 cents per cubic yard, measured in scows (abstract herewith). This bid was approved and a contract entered into October 4, 1892, for the removal of 16,500 cubic yards, more or less, of material. Operations were begun October 24, 1892, and continued without interruption to November 12, at which date 16,500 cubic yards of material had been removed, thus completing the contract.

Under this contract the slope left along the face by the previous dredging was removed to the full depth of 13 feet at mean low water, and one-third of an acre of the point of land was cut away, sloping off to the full depth as above at a distance of about 15 feet from the bank. This gives an additional width to the channel of from 15 to 60 feet. The total width of the channel at this point is now 725 feet.

It is desirable that a further appropriation of $4,500, the balance of the estimate, be made for the fiscal year ending June 30, 1895, as there are no funds in hand with which to complete the improvement, and the favorable results thus far attained seem to warrant the ultimate completion of the project.

The expenditures during the fiscal year ending June 30, 1893, amount to $4,845.15, as follows:

Dredging under contract	$3,960.00
Inspection	170.00
Drafting	210.00
Administration	505.15
Total	4,845.15

This work is in the collection district of New York, which is the nearest port of entry; nearest light-house, Bergen Point Light; nearest fort, Fort Tompkins.

Amount of revenue collected at the port of New York during the fiscal year ending June 30, 1893, is $138,032,031.18.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
August 11, 1888	$10,000.00
September 19, 1890	7,000.00
July 13, 1892	5,000.00
Total	22,000.00
Amount expended	21,090.74

Money statement.

July 1, 1892, balance unexpended	$754.41
Amount appropriated by act approved July 13, 1892	5,000.00
	5,754.41
June 30, 1893, amount expended during fiscal year	4,845.15
July 1, 1893, balance unexpended	909.26

but 12 feet deep over the remaining widths of 100 feet on each side. The estimated cost of this work was $125,705. In addition it was proposed, should it be found necessary, to build four detached dikes along the line of the channel—two on the north and two on the south side—the estimated cost of which was $60,000, bringing the total estimated cost of the proposed improvement up to $185,705. This estimate was, in 1883, further increased to $210,000 by Major (now Lieutenant-Colonel) Gillespie, at that time officer in charge of the improvement. A modification of the project, having in view the total rejection of the dikes, was submitted May 9, 1889, and was approved May 15.

A further modification of the original project, necessitated by the increasing demands of commerce, and the one under which the present appropriation is to be expended, was approved October 20, 1890. This project calls for a uniform channel depth of 14 feet at mean low water over the entire width of 400 feet.

The amount expended on this improvement to June 30, 1892, was $197,276.38 and the total amount of work accomplished consisted in the construction of the south dike above mentioned, and the dredging of a channel throughout the entire extent of the improvement, 13 feet in depth at mean low water, with widths varying from 300 to 350 feet. It should be added also that for 3,000 feet in the vicinity of the bend at the Stake Light the width had been increased to 400 feet, with low-water depths of from 13 to 14 feet.

An appropriation of $15,000 was made in the act of July 13, 1892. A project for the expenditure of this appropriation in widening and deepening the channel at such points as prove on examination to be most deficient, the work to be done by contract after advertisement and award, in accordance with regulations, was approved July 26, 1892.

Work under this project has been deferred during the fiscal year, it being considered necessary to have an examination made to determine the amount of filling that may have taken place along the channel sides since the last dredging. Such filling is certain to occur in the vicinity of the Corner Stake Light, and its removal late in the season, when it is expected more advantageous prices for doing the work can be obtained, will result in more benefit to the waterway than dredging at the present time at other localities not up to the full requirements of the project, though ample for present needs.

The expenditures during the fiscal year amount to $967.50 for office expenses.

This work is in the collection district of New York, which is the nearest port of entry. Nearest light-house, Bergen Point Light; nearest fort, Fort Tompkins.

Amount of revenue collected at the port of New York during the fiscal year ending June 30, 1893, $138,032,031.18.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
June 23, 1874 (diking)	$50,000.00
August 14, 1876 (dredging)	10,000.00
June 18, 1878	15,000.00
June 14, 1880	29,000.00
August 2, 1882	40,000.00
July 5, 1884	10,000.00
August 5, 1886	15,000.00
August 11, 1888	15,000.00
September 19, 1890	15,000.00
July 13, 1892	15,000.00
Total	214,000.00
Amount expended	198,243.88

Money statement.

July 1, 1892, balance unexpended	$1,723.62
Amount appropriated by act approved July 13, 1892	15,000.00
	16,723.62
June 30, 1893, amount expended during fiscal year	967.50
July 1, 1893, balance unexpended	15,756.12
Amount (estimated) required for completion of existing project	46,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of channel between Staten Island and New Jersey, during the year ending December 31, 1892, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Building material	688,432	$4,862,611	Steam	10,559	8	272
Coal	1,860,413	9,229,581	Sail	12,682	9	365
Fertilizers	342,245	10,159,373	Barges	170	14	414
Iron and ores	280,185	12,842,390	Rafts	1,545		
Miscellaneous	472,639	41,721,400				
Total	3,643,914	78,815,355		24,956		

F 6.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

The Passaic River is being improved under two separate projects, the first applying to the river below Center Street Bridge, Newark, to and beyond the shoal in Newark Bay, a distance of 7⅝ miles; the second, to the upper course of the river from Center Street Bridge as far as Passaic, a distance of 8 miles. The most recent appropriation was, however, made in a single sum for the entire river, and hereafter the two projects will be united in such a way that the funds can be expended at those parts of the river most urgently needing control or repair in the interests of navigation.

1. BELOW NEWARK.

The lower portion of the river, from the Center Street Bridge to Newark Bay, was first surveyed by the Engineer Department in 1879. The greatest depth in the channel at a point above the Elbow Beacon was only 7.1 feet, and in many places the greatest depth was 7.5 feet at mean low water. A project was adopted, based on this survey, providing for obtaining, by diking and dredging, a channel 200 feet wide and 10 feet deep at mean low water, from Center Street Bridge to Newark Bay, at a cost of $232,875.

This project was modified in 1884, pursuant to the river and harbor act of that year, providing for extending the dike at the mouth of the river into the bay, a distance of 12,000 feet, and for dredging a channel across the shoal in Newark Bay 200 feet wide and 10 feet deep at mean low water, increasing the original estimate to $353,875.

The amount expended to June 30, 1892, was $233,692.18, with which 6,205 feet of dike had been built and maintained, the channel through the shoal in the bay and the channel up the river as far as Lister Dock dredged to the required dimensions, and a bar above the Zinc Works Dock removed to the required depth, with a width of 120 feet, for a distance of 1,600 feet upstream.

The recent river and harbor act of July 13, 1892, appropriates $45,000 for the entire river both above and below Newark. A project for its expenditure in improving the river at certain points, the treatment of which will best conduce to the regulation of the tidal portion of the river in its entirety, was approved July 26, 1892, the portion of the project referring to this section of the river reading as follows:

For dredging between Center Street Bridge, Newark, and deep water in Newark Bay at points where the channel is deficient in width and depth, as provided for in the original project, $20,250.

Reserved for the preservation of the dike in Newark Bay, endangered by the reclaiming of isolated sections of land inside the approved bulkhead lines, or to be expended in dredging hereafter, as may seem most advantageous, and for which due authority will be obtained, $10,000.

Specifications were prepared and sealed proposals invited by advertisement, dated February 18, 1893, for widening and deepening the channel between Center Street Bridge and Lister Dock, Newark, by dredging to a 10 feet mean low water depth, where the existing mean low-water depth varies from 7 to 10 feet. Bids were opened March 29, 1893, the lowest bid received being that of Alonzo E. Smith, of Islip, N. Y., at 29.9 cents per cubic yard, measured in scows (abstract herewith). Upon investigation it was found that the bidder was not possessed of, nor could he procure, a plant adequate to the performance of the contract in accordance with the specifications, and the award was therefore made to the next lowest responsible bidder, P. Sanford Ross, of Jersey City, N. J., at 33 cents per cubic yard, measured in scows, and a contract entered into April 28, 1893, for the removal of about 60,000 cubic yards of material. Work was begun June 14, 1893, and at the close of the fiscal year 11,294 cubic yards had been removed.

A survey of Newark Bay, beginning at Bayonne, N. J., and extending to the Newark and New York Railroad Bridge, and of the river from Baeder and Adamson Dock to Center Street Bridge, Newark, was begun November 24, 1892, and completed December 24, 1892.

A comparison of this survey with the condition of the channel in Newark Bay, after dredging in 1885, reported to be 200 feet wide and 10 feet deep at mean low water, indicates that this improvement has not remained permanent, having shoaled about 1 foot between the Newark and New York Railroad Bridge and upper end of the dike, with a slight decrease in channel width from this point to its intersection with the channel of the Hackensack River, but on comparison with surveys made in 1884 and 1887 it shows a slight improvement of the channel, this being probably due to increased tidal flow resulting from improvements made in the river above the Newark and New York Railroad Bridge.

The expenditures on this section of the river during the fiscal year ending June 30, 1893, amount to $2,591.06, as follows:

Surveying	$839.93
Drafting	375.00
Inspection	210.00
Administration	1,166,13
Total	2,591.06

2. ABOVE NEWARK.

Before its improvement was undertaken the upper part of the river had a navigable 6-foot channel, except at Middle, Belleville, Rutherford Park, and Holzman bars, where the depths were 4.5 feet, 3.9 feet, 3 feet, and 3.5 feet, respectively.

The project of improvement was adopted in 1872, and provided for a channel across and above the shoals from 7½ to 6 feet deep at mean low water, and from 200 to 50 feet wide, to be obtained by dredging and diking, at a cost of $123,924. It was modified in 1885 by extending the channel below Middle Bar 1,500 feet to the Erie Railroad Bridge, increasing the estimate to $129,000, which was further increased in 1886 to $133,762. The deposit of material from freshets, as well as the difficult and costly nature of the dredging, prompted a recommendation to increase this last estimate to $193,822, which was approved October 6, 1890.

The amount expended to June 30, 1892, was $135,677.06, with which channels had been dredged to the requisite depth, with widths of from 60 to 75 feet, a channel through Third River Bar dredged to the required depth, with width of 100 feet for a distance of 800 feet and below this bar the channel increased in width by 40 feet with the same depth for a distance of 700 feet, and by 20 feet for a further distance of 245 feet, giving a continuous 100-foot channel through this reach, having a uniform depth of 6 feet at mean low water.

The river and harbor act of July 13, 1892, appropriates $45,000 for the entire river, both above and below Newark. A project for its expenditure in improving the river at certain points, in conformity with the general scheme, was approved July 26, 1892, that part of the project alluding to this section of the river reading as follows: "For dredging at Belleville Bar, completing the project, and at Rutherford Park Bar, widening the channel, $8,000."

Specifications were prepared and sealed proposals invited by advertisement, August 9, 1892, for excavating the channels at Belleville and Rutherford Park bars to the projected dimensions. Bids were opened September 15, 1892, the lowest bidder being James McSpirit, of Jersey City, N. J., at the following rates: For bowlders exceeding one-half of one cubic yard, $5 per cubic yard; for all other material, 75 cents per cubic yard (abstract herewith). This bid was approved and a contract entered into September 24, 1892. Work was begun October 5, 1892, and at the close of the month the channel through Belleville Bar was completed to the required width of 100 feet and mean low-water depth of from 6 to 7 feet; 2,105 cubic yards of stone, sand, clay, and bowlders were removed from this bar. Work began on Rutherford Park Bar November 4, 1892, and continued to the 12th, 480 cubic yards being removed. Owing to the lateness of the season and the extreme stage of low water in this section of the river, work became extremely difficult and the contractor was permitted to remove his plant for the winter months. The total amount of material removed under this contract to this date was 2,585 cubic yards.

The contractor under date of February 1, 1893, made written application for an extension of contract from February 1, 1893, to September 1, 1893, stating that the severity of the winter had set his work back, and that the character of the material to be removed from the reef at Rutherford was such as to prevent rapid progress. For these reasons an extension as requested was recommended and approved by the Chief of Engineers February 3, 1893.

Operations were resumed by the contractor at Rutherford Park Bar

May 19, 1893, and were in progress at the close of the fiscal year, the total amount of material removed under contract at that date being 5,200 cubic yards.

The expenditures during the fiscal year ending June 30, 1893, were $2,807.91, as follows:

Dredging under contract	$1,749.20
Inspection	295.33
Drafting	225.00
Administration	538.38
Total	2,807.91

The commerce is reported for the year ending December 31, 1892, as 1,362,647 tons, valued at $42,053,308; 24,360 vessels passed through the draw at the mouth of the river during the same period, as against 30,652 in 1891.

Passaic River is in the collection district of Newark, which is the nearest port of entry. Nearest light-house, Passaic Light, at the lower end of dike in Newark Bay. Fort Tompkins is the nearest fort.

Amount of revenue collected at the port of Newark during the fiscal year ending June 30, 1893, $12,448.65.

AMOUNTS APPROPRIATED.

	Below Newark.	Above Newark.	Total.
By act of Congress approved—			
June 10, 1872		$25,000.00	$25,000.00
Mar. 3, 1873		25,000.00	25,000.00
June 23, 1874		20,000.00	20,000.00
Mar. 3, 1875		20,000.00	20,000.00
Aug. 10, 1876		10.000.00	10,000.00
June 18, 1878		10,000.00	10,000.00
Mar. 3, 1879		2,000.00	2,000.00
June 14, 1880	$30,000.00	2,000.00	32,000.00
Mar. 3, 1881	50,000.00		50,000.00
Aug. 2, 1882	43,000.00	7,000.00	50,000.00
July 5, 1884	25,000.00	3,000.00	28,000.00
Aug. 5, 1886	24,000.00	2,250.00	26,250.00
Aug. 11, 1888	27,500.00	7,500.00	35,000.00
Sept. 19, 1890	40,000.00	5,100.00	45,100.00
July 13, 1892	For entire river		45,000.00
Total	239,500.00	138,850.00	423,350.00
Amount expended	236,283.24	138,484.97	374,768.21

It is recommended that an appropriation of $60,000 be made for the entire river for the fiscal year ending June 30, 1895.

As the river and harbor act approved July 13, 1892, makes the appropriation for the two reaches of the river under one heading, the following consolidated money statement for Passaic River is presented:

Money statement.

July 1, 1892, balance unexpended:		
Below Newark	$5,807.82	
Above Newark	3,172.94	
		$8,980.76
Amount appropriated by act approved July 13, 1892		45,000.00
		53,980.76
June 30, 1893, amount expended during fiscal year:		
Below Newark	2,591.06	
Above Newark	2,807.91	
		5,398.97
July 1, 1893, balance unexpended		48,581.79
July 1, 1893, outstanding liabilities	5,312.49	
July 1, 1893, amount covered by uncompleted contracts	20,744.15	
		26,056.64
July 1, 1893, balance available		22,525.15

Amount (estimated) required for completion of existing project.....$124,347.00
Amount that can be profitably expended in fiscal year ending June 30, 1895 60,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867, and of sundry civil act of March 3, 1893.

Abstract of bids for improving Passaic River, New Jersey, by dredging at Belleville and Rutherford Park bars, received and opened September 15, 1892, under advertisement, dated August 9, 1892.

Name and address of bidder.	Rate per cubic yard.		Amount available for dredging.	Amount that can be removed with available funds.
	Bowlders exceeding one-half of 1 cubic yard.	All other material.		
				Cubic yards.
Edgar M. Payn, Albany, N. Y	$7.00	$1.18	$8,000	1,143 to 6,780
James McSpirit, Jersey City, N. J*	5.00	0.75	8,000	1,600 to 10,667
Thomas H. Benton, Elizabethport, N. J	5.00	0.90	8,000	1,600 to 8,889

*Contract entered into September 24, 1892.

Abstract of bids for improving Passaic River, New Jersey, by dredging between Lister Dock and Center Street Bridge, Newark, received and opened March 29, 1893, under advertisement dated February 18, 1893.

Name and address of bidder.	Rate per cubic yard.	Amount available for dredging.	Amount that can be removed with available funds.
	Cents.		*Cubic yards.*
R. G. Packard, New York, N. Y	34	$20,000	58,824
P. Sanford Ross, Jersey City, N. J*	33	20,000	60,606
Alonzo E. Smith, Islip, L. I	29.9	20,000	66,890

*Contract entered into April 28, 1893, for the removal of 60,000 cubic yards, more or less, of material.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Passaic River, New Jersey, during the year ending December 31, 1892, were furnished by Mr. P. T. Quinn, secretary of the board of trade, Newark, N. J.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Building material	332,325	$4,106,581	Steam	10,269	9	475
Iron and ores	221,841	11,092,070	Sail	6,949	8	200
Fertilizers	342,732	3,473,000	Barges	5,852	6	200
Coal	75,000	300,000	Rafts	1,200		
Miscellaneous	390,749	23,081,657				
Total	1,362,647	42,053,308		24,360		

F 7.

IMPROVEMENT OF ELIZABETH RIVER, NEW JERSEY.

This stream, which is 2⅝ miles in length from its mouth to the head of navigation, at Broad street, Elizabeth, has a width of from 50 to 90 feet, and before its improvement the wharves in the city could only be reached at high water by vessels drawing less than 4 feet. Its commerce was estimated at 45,000 tons annually. The range of the tide was about 4.7 feet at its mouth and 3.4 feet at Bridge street.

The project for the improvement was adopted in 1878, and provides for obtaining by dredging a channel 60 feet wide and 7 feet deep at high water from the mouth of the river to the head of navigation, at an estimated cost of $25,530. The estimated cost, under the project of 1878, was increased in 1882 to $43,160.

A channel of the required dimensions was dredged in 1883 to within 1,000 feet of the Broad Street Bridge, but soon became obliterated by reason of deposits of silt and sewage refuse.

The total amount expended on this improvement to June 30, 1892, was $31,886.20.

There were no funds available for work on this improvement from 1883 until September 19, 1890, when the sum of $5,000 was appropriated in the river and harbor act of that date, and was expended in 1891 in removing shoals from the river at the bend above South street, at South Street Bridge, at John street, at the bend in the river below John street, and at the New York and Long Branch Railroad Bridge, to the required high-water depth, with widths of from 30 to 50 feet; thus providing a channel having a depth of 7 feet at mean high water from the mouth of the river to within 900 feet of the Bridge Street Bridge, in the town of Elizabeth. The widths of this channel were from 30 to 50 feet.

The act of July 13, 1892, also appropriated $5,000 for continuing the improvement, and a project for its expenditure by dredging in the vicinity of the Elizabeth wharves and such other sections of the river as might seem most advantageous after a survey of the river should have been made was approved July 26, 1892. This survey was begun November 3 and finished November 23, 1892; it indicates a channel from 30 to 50 feet wide, extending from the mouth to Bridge Street Bridge, the head of navigation, with mean high-water depths as follows: From mouth of the river to about 2,400 feet above the New York and Long Branch Railroad Bridge, 7 to 11 feet, thence to within 900 feet of the South Street Bridge, 6 to 7.3 feet, thence to bend above South Street Bridge, 5.3 to 6.9 feet; and from this point to the head of navigation at Bridge Street Bridge, about 2⅝ miles from the mouth, 4.1 to 5.8 feet.

Specifications were prepared and sealed proposals invited by advertisement February 18, 1893, for dredging the channel of the river between the bridges at South street and Bridge street to a depth of 7 feet at mean high water, where the existing depth is from 4 to 5 feet at the same stage, with widths of from 40 to 50 feet, and also at such other localities in the river as should be designated by the engineer officer in charge. No bids were received at the date of opening, March 29, 1893, and it was subsequently recommended that the work be left in abeyance until such time as it might be possible to obtain an advantageous offer from contractors to do the work by days' labor.

No active operations have been in progress during the fiscal year.

The expenditures during the fiscal year amount to $467.26, and have been for survey and office expenses, as follows:

Survey	$348.63
Administration	118.63
Total	467.26

The amount that could be profitably expended on this improvement during the fiscal year ending June 30, 1895, is the balance of the estimate, $6,160, and would be applied to the completion of the project.

Elizabeth River is in the collection district of Newark, N. J. Nearest light-house, Bergen Point Light. Nearest fort, Fort Tompkins.

Amount of revenue collected at the port of Newark during the fiscal year ending June 30, 1893, is $12,448.65.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
March 3, 1879	$7,500.00
June 14, 1880	7,500.00
March 3, 1881	4,000.00
August 2, 1882	8,000.00
September 19, 1890	5,000.00
July 13, 1892	5,000.00
Total	37,000.00
Amount expended	32,353.46

Money statement.

July 1, 1892, balance unexpended	$113.80
Amount appropriated by act approved July 13, 1892	5,000.00
	5,113.80
June 30, 1893, amount expended during fiscal year	467.26
July 1, 1893, balance unexpended	4,646.54
Amount (estimated) required for completion of existing project	6,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	6,160.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Elizabeth River, New Jersey, were furnished by Mr. Thomas H. Benton, of Elizabethport, N. J., for year ending December 31, 1892:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Coal	15,300	$70,500	Steam	10	5	12
Building material	22,775	143,000	Sail	70	6	70
Miscellaneous	1,500	7,500	Barges	243	6	100
			Rafts	4		
Total	39,575	221,000		327		

The above table shows an increase in the commerce of 3,350 tons over that reported for calendar year 1891.

F 8.

IMPROVEMENT OF RAHWAY RIVER, NEW JERSEY.

In its original condition the Rahway River had a depth of 8 feet and more at mean high water from its mouth to Bricktown, 3⅝ miles; 7 feet at Edgar Dock, 4½ miles; 4.4 feet to Milton Avenue Bridge, 4¾ miles; and 4 feet to Main Street Bridge, 5 miles, in the town of Rahway. Its commerce was estimated at 120,000 tons, and three attempts had been made to establish a line of steamboats on the river, but had failed on account of the bad condition of the stream.

The original project for its improvement was adopted in 1878, and provided for dredging a channel 125 feet wide and 8 feet deep at high water from Bricktown to Milton Avenue Bridge, and 100 feet wide from that point to Main Street Bridge. The tide rises about 5 feet at the mouth and 4 feet at the head of navigation.

There has been no appropriation for this work since 1882, and the channels have reverted nearly to their original condition owing to deposition of freshet material, sewage, etc.

If it is the intention of Congress to complete the improvement, the balance of the estimate ($29,250) could be profitably used in redredging the channels in accordance with the original project.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. The nearest light-house is Princess Bay Light, and Fort Tompkins is the nearest fort.

Amount of revenue collected during the fiscal year ending June 30, 1893, at the port of Perth Amboy, N. J., is $22,680.83.

Original estimate (1878)	$36,653
Revised estimate (1882)	66,250

AMOUNTS APPROPRIATED.

By act of Congress approved—	
March 3, 1879	$10,000
June 14, 1880	10,000
March 3, 1881	10,000
August 2, 1882	7,000
Total	37,000
Amount expended	37,000

Money statement.

Amount (estimated) required for completion of existing project	$29,250.00
Amount that can be profitably expended in fiscal year ending June, 30, 1895	29,250.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following letter contains all of the obtainable information in regard to the commerce of Rahway River, New Jersey, during the year ending December 31, 1892:

RAHWAY, *March 8, 1893.*

MY DEAR SIR: While not in position to give you a detailed statement by tonnage of exports and imports through Rahway River during year ending December 31, 1892, yet I have ascertained that about 3,000,000 brick and other masons' material were landed at Rahway by light-draft sailing vessels during the year, with a slight falling off of coal tonnage from the year previous. Rahway now has a more healthy growth than for many years past, which will of course augment the commerce of our river; and the completion of the improvement yet unfinished by your Department of the Government would, to my mind, add materially to such commerce. My absence

from home, together with sickness in my family, has prevented an earlier reply to your letter.

Yours, very respectfully,

JOSEPH M. POTTER.

THOS. L. CASEY,
Captain of Engineers, U. S. A.

F 9.

IMPROVEMENT OF RARITAN RIVER, NEW JERSEY.

Before its improvement by the United States the Raritan River had a depth of 8.5 feet at "The Stakes," 3 miles; of 6.5 feet at the "Middle Grounds," 4½ miles; of 7.5 feet at Whitehead Sand Dock, 8½ miles; and between this point and New Brunswick, 12¼ miles above the mouth, the channel was obstructed by a number of rocky shoals with depths of from 8.4 feet to 6.9 feet at mean low water. The city of New Brunswick and the Delaware and Raritan Canal, which terminates here, together with extensive brickyards on the South River, had an extensive commerce on the stream, estimated in 1871 at 3,053,857 tons per annum.

The present project was adopted in 1874, and provides for obtaining by diking and dredging, and where necessary, by drilling and blasting rock, a channel 200 feet wide and 10 feet deep at mean low water, from the mouth to New Brunswick, at a cost of $2,093,662.05. It was modified in 1881, pursuant to the river and harbor act of that year, by adding to it the dredging of the south channel, about 13,000 feet long, 100 feet wide, and 5½ feet deep at mean low water, from Kearney Dock to Crab Island.

Under this project $555,489.18 had been expended June 30, 1892, in constructing the dikes required by the project at "The Stakes" and "Middle Grounds," in dredging channels 200 feet wide and 12 feet deep at mean low water at these points, in drilling, blasting, and dredging a channel of the same dimensions across the rocky shoals at Whitehead Sand Dock, and thence up the river, with a width of 100 feet and depth of 10 feet, to within 2,280 feet of New Brunswick. Under two special allotments made for it in the acts of March 3, 1881, and August 2, 1882, the south channel was dredged to the required depth for a distance of 4,000 feet. These improvements had been of decided benefit to navigation. The commerce of the river was reported in 1887 at 1,675,355 tons, valued at $28,119,173; in 1890 at 1,661,425 tons, valued at $29,877,365; in 1891, 1,566,888 tons, valued at $31,031,299, and during the past year it is reported to be 1,120,302 tons, valued at $27,694,017.

Forty thousand dollars was appropriated in the river and harbor act of July 13, 1892, for continuing this improvement. A project for the expenditure of these funds in excavating a channel 100 feet wide and 10 feet deep at mean low water through the rocky shoals along the line of the bulkhead, extending toward the canal lock at New Brunswick, by means of the United States dredging plant, also in dredging the south channel to the required width and depth, and in making necessary repairs to dikes in the river, was approved July 27, 1892.

Operations with the United States dredging plant were continued to December 21, 1892, at which date it became necessary to withdraw the plant for the season and place it in winter quarters at Perth Amboy, N. J. When the plant had been made secure for the winter the crew was discharged, only the necessary watchmen to guard it being retained. During the season's work, beginning April 8, 1892, and ending December 21, 1892, 9,816 cubic yards of material were removed and deposited; of this amount 8,425 cubic yards was shale rock, the remainder being sand and gravel, bringing the channel, with a width of 100

feet and depth of 10 feet at mean low water, to within 1,880 feet of the canal lock in New Brunswick. One hundred and sixty surface blasts, aggregating 18,750 pounds of XX Forcite powder, were fired.

Some necessary repairs to the timber dikes were made during the months of July, August, September, and October, 1892.

Under authority dated August 9, 1892, for redredging the channel to Acken Dock to a depth of 6 feet, mean low water, and width of 50 feet, work was begun August 17, 1892, by hired plant, consisting of dredge, tugboat, and three scows, at $65 per day, and the improvement completed August 27, 1892, 3,287 cubic yards of material having been removed. This carried the channel, with the indicated width and depth from the river to the wharf, a distance of about 600 feet.

Necessary repairs having been made between March 16 and April 8, 1893, at a cost of $1,865.96, the plant was towed from winter quarters at Perth Amboy, N. J., to the Raritan River on April 10, at which date operations were resumed where the work of 1892 terminated, viz, at a point about 1,880 feet below the canal lock. The work was continued without serious interruption to the close of the fiscal year, 4,520 cubic yards being removed. This material as usual consisted almost entirely of shale rock, which was utilized in the construction of earth dike "C," at the "Middle Grounds." Twenty surface blasts, aggregating 5,600 pounds of XX Forcite powder, were fired. Twenty-five piles were driven to mark the line of the earth dike referred to above.

The work during the fiscal year has consisted entirely of rock dredging. The 10-foot, mean low water, channel, with a width of 100 feet now extends to within 1,880 feet of the canal lock at New Brunswick.

Some additional items of interest are given in the appended report of Mr. C. S. Kelsey, who has been in local oversight of the work. The accompanying map will show the condition of the section completed during the season of 1892.

The following tabular statement gives the amount and cost of work done by the United States dredging plant during the fiscal year:

Months.	Number of working days.	Actual time.		Average amount dredged per actual working day.	Amount dredged and deposited.			Expenses.		Cost of dredging and depositing per cubic yard.	Cost per cubic yard, including interest on original cost of plant.*
		Worked.	Lost.		Sand, gravel, and loose shale.	Blasted shale rock.	Total.	Operating, including maintenance while idle.	Repairs.		
1892.		*Days.*	*Days.*	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*	*Cubic yards.*				
July	25	21	4	53		1,104	1,104	$1,861.45	$39.93	$1.722	$1.857
August	27	23	4	57		1,322	1,322	2,594.52	22.66	1.980	2.092
September	25	21	4	55		1,141	1,141	1,719.38	85.49	1.582	1.712
October	25	21	4	64		1,329	1,329	1,941.46	220.53	1.627	1.739
November	24	18	6	64½	110	1,052	1,162	1,535.29	115.20	1.420	1.549
December	26	16	10	66½	83	1,014	1,097	1,035.40	10.84	0.954	1.090
1893.											
January	25		25					145.00			
February	24		24					145.00			
March	26		26					158.90	794.13		
April	25	13	12	102½	930	401	1,331	929.31	579.84	1.134	1.246
May	26	19	7	93	1,265	503	1,768	1,675.68	491.99	1.226	1.310
June	26	23	3	61½		1,421	1,421	1,942.25	36.29	1.392	1.497
Totals and averages.	304	175	129	67	2,388	9,287	11,675	15,683.64	2,396.90	1.549	1.702
								18,080.54			

* Interest computed at 4 per cent.

The expenditures during the fiscal year amount to $21,877.09, as follows:

Dredging by United States dredging plant	$17,128.38
Dredging by hired plant at Acken Dock	650.00
Repairing timber dikes and constructing earth dike	1,884.84
Inspection	1,161.67
Drafting	210.00
Administration	842.20
Total	21,877.09

The amount which can be expended profitably, as regards the efficient prosecution of the work, during the fiscal year ending June 30, 1895, is $100,000, and if appropriated will be expended in carrying the improved channel farther up the river toward New Brunswick.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay; nearest fort, fort at Sandy Hook, N. J.

Amount of revenue collected at the port of Perth Amboy during ths fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
June 18, 1878	$200,000.00
March 3, 1879	60,000.00
June 11, 1880	100,000.00
March 3, 1881	25,000.00
August 2, 1882	25,000.00
July 5, 1884	35,000.00
August 5, 1886	26,250.00
August 11, 1888	50,000.00
September 19, 1890	50,000.00
July 13, 1892	40,000.00
Total	611,250.00
Amount expended	577,366.27

Money statement.

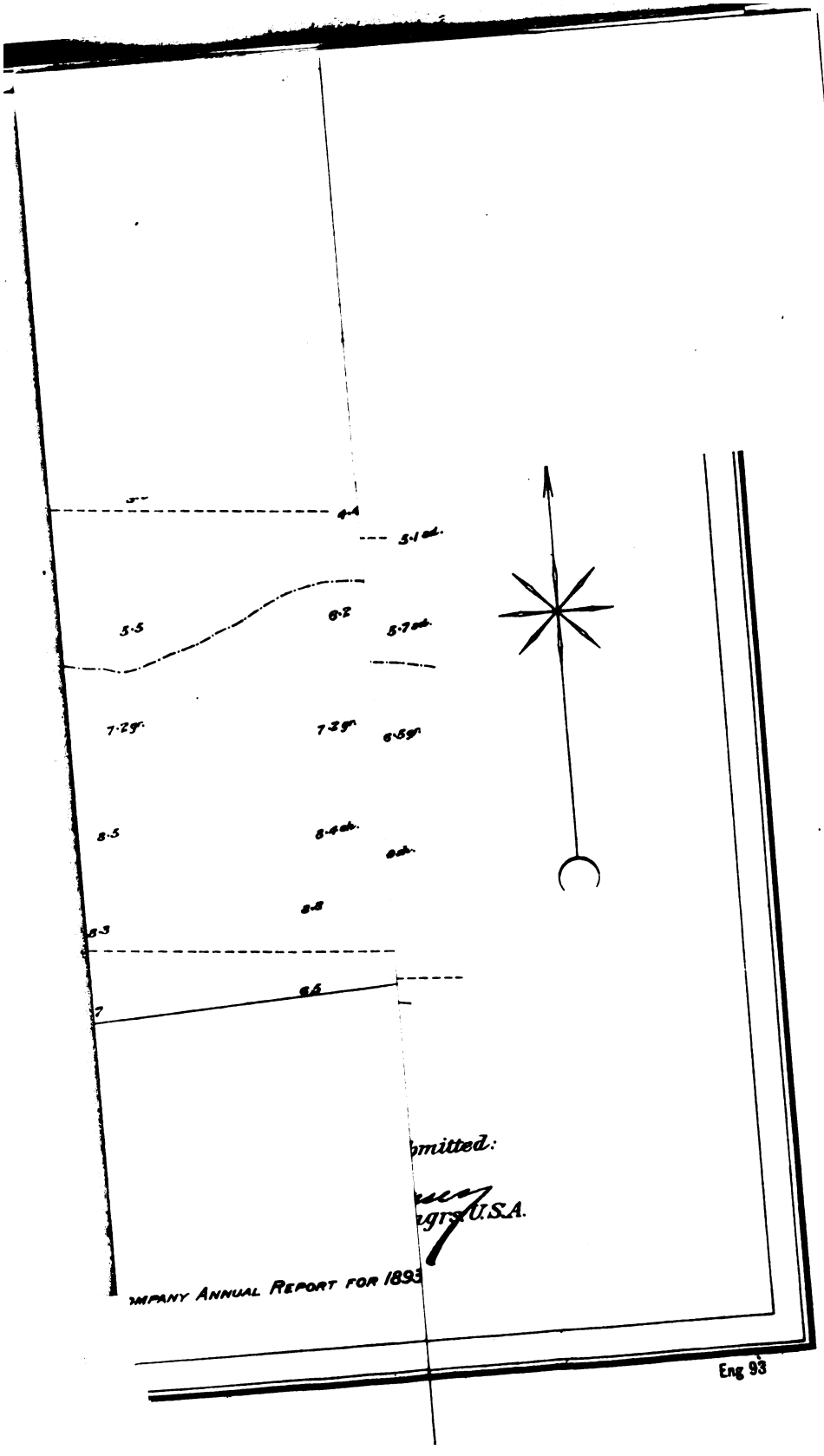
July 1, 1892, balance unexpended	$15,760.82
Amount appropriated by act approved July 13, 1892	40,000.00
	55,760.82
June 30, 1893, amount expended during fiscal year	21,877.09
July 1, 1893, balance unexpended	33,883.73
July 1, 1893, outstanding liabilities	3,116.73
July 1, 1893, balance available	30,767.00
Amount (estimated) required for completion of existing project	1,482,412.05
Amount that can be profitably expended in fiscal year ending June 30, 1895	100,000.00

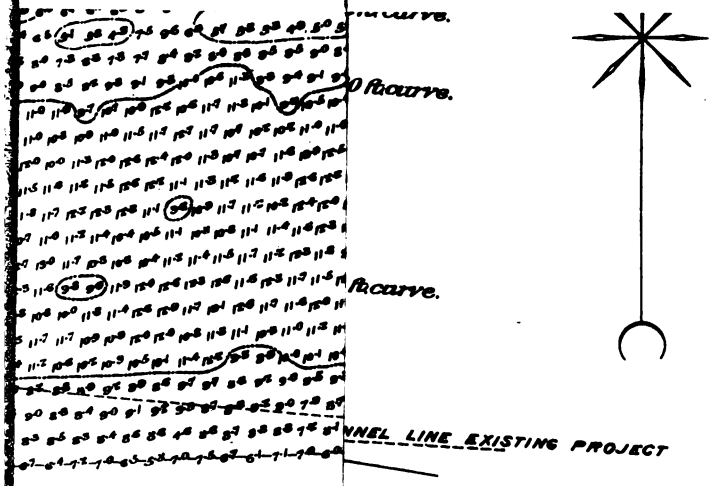
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

REPORT OF MR. C. S. KELSEY, ASSISTANT ENGINEER.

NEW YORK, *June 30, 1893.*

CAPTAIN: Operations on the Raritan River were continued thoughout the remainder of the working season of 1892 under substantially the same methods as were outlined in the last Annual Report. A section 400 feet long and 100 feet wide, begun May 26, 1892, was reduced to the required depth and the entire area redredged


4·4
5·1 est.
5·5
6·2
5·7 est.
7·29
7·39
6·59
8·5
8·4 est.
est.
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5·3
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7
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...ly submitted:
...R. Casey
...t. of Engrs U.S.A.

...PANY ANNUAL REPORT FOR 1893.

to recover the loose blocks remaining. Cross-sections made at this time, taking the depth at intervals of 10 feet in each direction, developed but two shoal soundings, loose blocks since removed. On drifting a sweep over the section, however, other loose blocks were detected and the section could not be reported as finished at the close of the year.

Of the facts worthy of note concerning this half-year's work were, first, the increased hardness of the rock. The amount of explosive used per cubic yard of rock removed was three times that required on the preceding section. With this increased expenditure of power the average daily cube removed was maintained. This was accomplished, however, largely by reason of a reduction of 35 per cent in the amount of time lost, due to the strengthening of weak parts that had been going on, and by improvements giving increased efficiency, that had been suggested by previous work.

It was found that better results were obtained, with the same amount of explosive by using heavier charges at longer intervals; and 50-pound charges spaced from 10 to 15 feet apart became the practice.

Durable dipper teeth were secured. The set described at length in the Report of last year more than fulfilled their promise and have been in use the entire year. To test the efficiency of cast-steel teeth, a set of exactly the same pattern, made at one of the best-known foundries, and of a quality of steel as seemed, in their experience, best adapted to the work, were tried. All of the set were fractured after a few hours' work.

A place measurement of this section was made from surveys after completion of the work, showing a ratio of 1 to 2 as compared with the scow measurement reported. This is the same result as found last year.

A place measurement was computed, also, as the work progressed, by calculating the water displacement of each scow. As a portion of the load is submerged in the scow-wells this method was considered uncertain until the surveys were made and a close agreement found in the two methods. The displacement measurements have been continued as being more reliable than an estimate of the rock in irregular masses.

When the plant came out of winter quarters it was in better condition than ever before for performing this work. The hull of the dredge had been strengthened under the turntable, dippers repaired, worn-out chain renewed, machinery overhauled, all rivets tested, and extra spuds, dipper teeth, etc., provided. The tug having been out of commission for a year required extensive repairs, including new stern bearing, lead sleeve, increased steering power, new bits, roof covering, etc. Two of the dump-scows were decked over and adapted to the new order of the work proposed. Much of this work was performed by the crews employed upon the plant.

The approved plan of work for the year 1893 involved two radical changes; one in the method of placing the charges upon the river bed, and another in the disposal of the rock removed. Hitherto most of the rock had been deposited with the gravel at the shoal water dumping ground in the Lower Raritan. The construction of a riprap dike of the Raritan shale was begun along the line of the proposed earth dike C. After the timber dikes were built in the Raritan it was found that the channel dredged between the north shore and the line of dikes was shoaling at a locality where it had been impracticable to secure a uniform section by a single line of dikes. This shoaling continued and in 1888 a dike to be built along the north shore with the material dredged from year to year was planned to remedy this defect. Its construction was discontinued in 1890, after two years trial, because of the light nature of the material, readily wasted, and of the uncertainty in the delivery of protecting riprap.

For three years dredged material has been deposited on the flats back of the dikes. Last year the amount of gravel removed was small and promised less for this year. The rock is durable under water, and it is believed that a substantial and permanent dike can be constructed at little or no cost to the work and of permanent benefit to the river channel at this point. This disposal of the rock dispenses with the hired light-draft tug and puts into commission the tug belonging to the plant. The difference between the cost of running the one and the hire of the other is more than enough to pay for unloading the stone into the dike, so that it is being built at no additional cost to the work. One thousand two hundred and seventy-one cubic yards have already been placed in the dike. The stone that has been purchased for this dike heretofore has cost $1.25 per yard.

A simple method of accurately and quickly placing charges of explosive upon the river bed independent from the dredge was desirable. A uniform spacing of 6 feet, lengthwise and across, was adopted. A scow 6 feet wide by 30 feet long was employed. Four poles on either side, 6 feet apart, are free to rest upon the river bottom. Eight charges are weighted, connected and wired in the usual manner, and, by an arrangement, lowered simultaneously and left, one at the foot of each pole. A single blast, then, extends over a space the width of cutting made by the dredge and 12 feet in length. The scow is easily handled by oars and two such blasts made

during the period of high water. Charges of 25 pounds weight, or a total of 200 pounds to each blast have been employed.

Ranges for locating the position of the scow were established. The advantage of systematically placing the charges was at once apparent. The rock was broken more uniformly and seldom was a second blast over the same area required.

The first cut of the new section has been completed and shows a gain of 40 per cent in the rate of progress over that made on the first cut of the preceding section. The conditions are the same and the quality of the rock unaltered. About the same amount of rock was removed, and with little increase in the amount of explosive required.

There is a promise of a further advance in the completed channel during this year than was made during the last.

A comparison of the tables submitted, showing the work during this fiscal year and the last, shows a gain in the totals of time worked and lost; an increase of 50 per cent in the amount of rock removed; and a decrease in the cost of rock work of 15 per cent, assuming a uniform cost for gravel removed of 30 cents per cubic yard.

The increase shown in operating expenses is due to amount of explosive employed; the increase in the total for repairs, to the refitting of the tug.

During the year, 1,670 linear feet of wale along the dikes was renewed, and 890 cubic yards of rock from the river used in refilling, at a cost of 70 cents per linear foot.

Respectfully submitted.

C. S. KELSEY,
Assistant Engineer.

Capt. THOS. L. CASEY,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Raritan River, New Jersey, during the year ending December 31, 1892, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Building material	423,111	$2,178,890	Steam	1,617	7	166
Coal	267,490	1,122,140	Sail	2,131	9	206
Sand and clay	135,845	170,067	Barges	4,560	6	178
Iron and ores	33,344	1,000,320	Rafts	164		
Miscellaneous	260,512	23,232,600				
Total	1,120,302	27,694,017		8,472		

F 10.

IMPROVEMENT OF SOUTH RIVER, NEW JERSEY.

Before the improvement of this stream was undertaken by the United States the navigation of the lower 2½ miles of its course had been abandoned, and a canal dredged at private expense from a short distance below Washington to Sayreville on the Raritan River. In 1880 the mouth of this canal, on account of its faulty location, had shoaled to a depth of 6.4 feet at mean low water, and the best depth in the canal, some distance above, had decreased to 3.3 feet. Above Washington a depth of 2.7 feet existed to Bissetts, 3⅝ miles, and 2.5 feet to Old Bridge, the head of navigation, 6¼ miles above the mouth of the canal at Sayreville. The range of the tide was 5.3 feet at Sayreville. The town of Washington and numerous brickyards did a commerce on the river valued at $1,249,000.

The project adopted in 1880 provided for closing the river below the head of the canal, correcting the direction of the mouth of the latter,

and obtaining, by diking and dredging, a depth of 8 feet mean low water to Washington, 6 feet to Bissetts, and 4 feet to Old Bridge, straightening the channel at two points by cutting across the meadow, estimated to cost $194,695. This was modified July 30, 1892, by omitting the proposed dredging of the cut-off above Washington and in front of the brickyards; the construction of dikes H, I, J, K, and L, and substituting therefor the dredging of the section of the river between Washington and the Raritan River railroad bridge, removing about 39,000 cubic yards of material, estimated at 40 cents per cubic yard, reducing the original estimate to $176,975.

The amount expended to June 30, 1892, was $69,552.87, with which the direction of the mouth of the canal has been changed, the dikes below Washington completed and maintained, a small amount of dredging done on a shoal above Washington, a shoal at the mouth of Washington Canal removed, and a channel dredged 60 feet wide through the canal and 50 feet wide across the shoal in the river below Washington. The channel below the draw of the Raritan River railroad bridge was given a depth of 4 feet at mean low water, with additional width of 25 feet for a distance of 350 feet, and for a like distance above the bridge the width was increased to 70 feet. At Rourke Reach the channel was given a depth of 6 feet at mean low water and width of 60 feet for a distance of 860 feet; in addition a bar opposite Whitehead's Brickyard was removed to a depth of 8 feet at mean low water and width of 60 feet for a distance of 450 feet, and at the junction of the canal and South River a channel was excavated 350 feet long, 60 feet wide, and 6 feet deep at mean low water.

The river and harbor act of July 13, 1892, appropriated $7,000 for continuing the improvement, and a project for its expenditure, in dredging a section of the river between the Turnpike or County Bridge and Bissett's, was approved July 30, 1892, the work to be done by contract in accordance with regulations. Specifications were prepared and sealed proposals invited by advertisement, August 9, 1892, for dredging the reach between the bridges above Washington 6 feet deep at mean low water, and as wide as the funds available would admit. Bids were opened September 15, 1892, the lowest bidder being William H. Taylor, of Jersey City, N. J., at 29½ cents per cubic yard, measured in scows (abstract herewith). This bid was approved and a contract entered into September 28, 1892, for the removal of about 19,000 cubic yards of material. Work was begun October 3, 1892, and continued without interruption to December 22, 1892, when the formation of ice in the river compelled the suspension of active operations for the winter months, and necessitated the granting of an extension of the contract from February 1 to April 30, 1893, upon the written request of the contractor dated January 23, 1893, approved by the Chief of Engineers, U. S. Army, January 27, 1893.

Work was resumed March 29, 1893, and the contract completed April 30, 1893, the total amount of material removed having been 18,028 cubic yards, giving a channel 1,850 feet long, 50 to 100 feet wide, and 6 feet deep at mean low water, extending upstream from the Turnpike Bridge and connecting with a channel of similar depth existing as far as the Raritan River Railroad Bridge, a width of 100 feet being maintained for the first 200 feet of its length, 75 feet for an additional 585 feet, and 50 feet for the remainder.

The present condition of the river is such that it may be navigated by vessels of 6 feet draft at all stages of the tide for a distance of about 3 miles above its mouth.

The expenditures during the fiscal year amount to $6,486.10, as follows:

Dredging under contract	$5,318.27
Inspection	429.73
Drafting	150.00
Administration	588.10
Total	6,486.10

The sum of $30,000 can be expended profitably as regards the efficient prosecution of the work during the fiscal year ending June 30, 1895. It would be applied to giving the channel the full dimensions required by the project.

This work is in the collection district of Perth Amboy, which is the nearest port of entry; nearest light-house, Great Beds Light, in Raritan Bay, New Jersey; nearest fort, fort at Sandy Hook, New Jersey.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
June 14, 1880	$40,000
March 3, 1881	6,000
August 2, 1882	10,000
August 5, 1886	5,000
August 11, 1888	5,000
September 19, 1890	5,000
July 13, 1892	7,000
Total	78,000
Amount expended	76,039.97

Money statement.

July 1, 1892, balance unexpended	$1,447.13
Amount appropriated by act approved July 13, 1892	7,000.00
	8,447.13
June 30, 1893, amount expended during fiscal year	6,486.10
July 1, 1893, balance unexpended	1,961.03
Amount (estimated) required for completion of existing project	98,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of bids for improving South River, New Jersey, by dredging, received and opened September 15, 1892, under advertisement dated August 9, 1892.

Name and address of bidder.	Rate per cubic yard.	Amount available for dredging.	Amount that can be removed with available funds.
	Cents.		*Cu. yds.*
John P. Randerson, Albany, N. Y	35⅞	$5,600	15,775
Edgar M. Payn, Albany, N. Y	41⅛	5,600	13,453
Peter W. Myers, Albany, N. Y	33	5,600	16,970
William H. Taylor, Jersey City, N. J.*	29½	5,600	19,000
James McSpirit, Jersey City, N. J	36	5,600	15,555
Thomas H. Benton, Elizabeth, N. J	49	5,600	11,430

*Contract entered into September 28, 1892, for the removal of 19,000 cubic yards, more or less, of material.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of South River, New Jersey, during the year ending December 31, 1892, were furnished by Mr. E. A. Fisher, of Sayreville, N. J.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Building material	135,262	$302,000	Steam			
Sand, clay, etc	6,000	12,500	Sail	1,258	6	67
Coal and wood	9,200	36,800	Barges	415	6	115
Fertilizers	11,000	16,500				
Miscellaneous	1,000	2,500				
Total	162,462	370,300		1,673		

The above table shows a decrease of 207,873 tons when compared with amount reported for calendar year 1891.

F 11.

IMPROVEMENT OF KEYPORT HARBOR, NEW JERSEY.

Keyport Harbor was originally accessible at low water only to vessels drawing less than 4 feet. Before its improvement was undertaken by the United States a 6-foot channel had been dredged at private expense which had shoaled in 1872 to 5½ feet and in 1882 to 5 feet, the range of the tide being 4.7 feet. A large commerce was carried on, however, valued at $2,932,000.

The project for the improvement was adopted in 1873, and provides for dredging a channel 4,700 feet long, 8 feet deep at mean low water, and 200 feet wide from the steamboat dock to the 8-foot contour in Raritan Bay, at an estimated cost of $30,475. No money was appropriated for this purpose, however, until August 2, 1882. A subsequent survey showed that material shoaling had taken place in the channel since 1872, the date of the original survey, necessitating an increase of the original estimate to $40,475.

The amount expended under this project to June 30, 1892, was $30,475, with which a channel had been dredged to the required depth from the 8-foot contour in Raritan Bay to Keyport Wharf, a distance of 5,000 feet, with a width of 200 feet for the first 4,200 feet and 160 feet for the remainder.

There had been no appropriation for this work since 1882, until the sum of $5,000 was made available, for continuing the improvement, in the river and harbor act of July 13, 1892.

A project for the expenditure of this appropriation in dredging, widening, and deepening the channel within the prescribed limits, at such places as were found on examination to be most advantageous, was approved July 25, 1892. A survey was made in October, 1892, and also a series of tidal observations extending through October to December 25, 1892, for the purpose of establishing a mean low-water datum plane for Keyport Harbor. The result of this survey revealed mean low-water depths of 6 to 8 feet, through widths of from 60 to 175 feet, the channel having thus deteriorated from an 8-foot depth with widths of 160 to 200 feet at date of examination immediately after dredging in 1883.

Specifications were prepared and sealed proposals invited by advertisement February 18, 1893, for widening and deepening the channel between Keyport Steamboat Docks and Raritan Bay, by dredging to a depth of 8 feet at mean low water, where depth of from 4 to 7 feet at mean low water already existed. Bids were opened March 29, 1893, the lowest bidder being R. G. Packard, of New York, N. Y., at 28 cents per cubic yard measured in scows (abstract herewith). This bid was approved and a contract entered into April 7, 1893, for the removal of about 14,000 cubic yards of material. Work was begun May 10, 1893, and the contract completed June 1, 1893, the total amount of material removed under it being 14,999 cubic yards. Under this contract the channel in front of the steamboat docks was dredged to a width of from 70 to 140 feet and depth of 8 feet at mean low water for a distance of 400 feet, thence for a distance of 2,200 feet outward, a cut 35 feet wide was dredged to the required depth of 8 feet along the northerly side of the old channel. The channel formerly dredged through this section had filled in to a depth of from 6 to 7 feet at mean low water through widths varying from 30 to 50 feet.

The commerce of the harbor has recently increased to a considerable extent, being reported for the calendar year 1892, at 358,391 tons, valued at $6,562,200.

The expenditures during the fiscal year amount to $4,914.32, as follows:

Dredging under contract	$4,199.72
Inspection	200.00
Surveying	214.22
Drafting	105.00
Administration	195.38
Total	4,914.32

The balance of the estimate $5,000, can be profitably expended during the fiscal year ending June 30, 1895.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay; nearest fort, fort at Sandy Hook, N. J.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
August 2, 1882	$30,475.00
July 13, 1892	5,000.00
Total	35,475.00
Amount expended	35,389.32

Money statement.

Amount appropriated by act approved July 13, 1892	$5,000.00
June 30, 1893, amount expended during fiscal year	4,914.32
July 1, 1893, balance unexpended	85.68
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of bids for improving Keyport Harbor, New Jersey, by dredging, received and opened March 29, 1893, under advertisement dated February 18, 1893.

Name and address of bidder.	Rate per cubic yard.	Amount available for dredging.	Amount that can be removed with available funds.
	Cents.		*Cubic yards.*
R. G. Packard, New York, N. Y.*	28	$4,000	14,286
P. Sanford Ross, Jersey City, N. J	30	4,000	13,333
Alonzo E. Smith, Islip, Long Island	30	4,000	13,333

*Contract entered into April 7, 1893, for the removal of 14,000 cubic yards, more or less, of material.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Keyport Harbor, New Jersey during the year ending December 31, 1892, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Produce	97,226	$3,722,600	Steam	4	6½	453
Brick	150,000	550,000	Sail	20	6	75
Fertilizers	80,000	350,000	Barges	100	6	150
Lumber	10,000	10,000				
Coal and wood	5,000	7,000				
Miscellaneous	16,165	1,922,600				
Total	358,391	6,562,200		124		

The above table shows an increase of 117,139 tons over amount given in 1891.

F 12.

IMPROVEMENT OF MATTAWAN CREEK, NEW JERSEY.

Before its improvement by the Government this small stream was obstructed at its entrance into Keyport Harbor by a mud flat on which the best depth at the worst section was 3.1 feet at mean low water, though the 3-foot channel was too narrow and tortuous for use. Above this flat a good 4 foot channel existed to 1⅛ miles above the mouth and thence to the steamboat dock at Mattawan 3.5 feet, shoaling to 1.8 feet at the freight dock 600 feet above and 1⅞ miles from the mouth. The range of the tide is 4.7 feet. Notwithstanding the above difficulties it carried commerce valued in 1880 at $800,000. In 1885 the commerce of the creek was stated to be 130,000 tons, valued at $2,000,000. It has since increased to 326,500 tons, valued at $3,117,000.

The project for this improvement was adopted in 1881, and provides for dredging a channel 4 feet deep at mean low water and 100 feet wide from the mouth to Winkson Creek, and thence 75 feet wide to the railroad bridge at Mattawan, 250 feet above the freight dock, at an estimated cost of $33,120.

Appropriations were made for this improvement to the close of the fiscal year ending June 30, 1892, as follows: March 3, 1881, $15,000,

August 2, 1882, $6,000, and September 19, 1890, $2,500. With the appropriations of 1881 and 1882, the channels had been dredged to the required depth from the mouth to the freight dock at Mattawan, with widths of from 100 to 30 feet. The small appropriation of 1890 enlarged the dimensions of the channel through the flat outside the creek nearly to the requirements of the project and also for a distance of 1,420 feet upstream from its mouth.

The river and harbor act of July 13, 1892, appropriated $9,620 for completing the improvement, and a project for its expenditure in dredging the channels to the full dimensions was approved July 27, 1892. A survey of this stream, begun October 24 and completed November 3, 1892, shows that the channels dredged in 1881 and 1882 have almost reverted to their original condition, and that the amount of work required to complete the project can not be performed with the available funds; consequently a revised estimate for completing the project, increasing the original by $10,000, was submitted for the approval of the Chief of Engineers, May 29, 1893.

Specifications were prepared and sealed proposals invited by advertisement February 18, 1893, for widening and deepening the channel of Mattawan Creek, by dredging above Winkson Creek and also between the mouth of the creek and the steamboat dock at Keyport. Bids were opened March 29, 1893, the lowest bid received being that of Alonzo E. Smith, of Islip, N. Y., at 30 cents per cubic yard measured in scows, or 25 cents per cubic yard if allowed to deposit on the bank without using scows. [Abstract herewith.] This bid was approved and a contract entered into May 3, 1893, for the removal of about 25,000 cubic yards of material, at 30 cents per cubic yard, measured in scows. Work under this contract was begun June 24, 1893, and was in progress at the close of the fiscal year, 2,617 cubic yards having been removed.

The expenditures during the fiscal year amount to $635.71, as follows:

Surveying	$199.51
Drafting	75.00
Inspection	166.67
Administration	194.53
Total	635.71

If it is the intention of Congress to complete the improvement the sum of $10,000 can be expended profitably, as regards the efficient prosecution of the work, during the fiscal year ending June 30, 1895, and would be applied to redredging the channel.

This work is in the collection district of Perth Amboy, which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay. Nearest fort, fort at Sandy Hook, N. J.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
March 3, 1881	$15,000.00
August 2, 1882	6,000.00
September 19, 1890	2,500.00
July 13, 1892	9,620.00
Total	33,120.00
Amount expended	24,121.58

Money statement.

July 1, 1892, balance unexpended		$14.13
Amount appropriated by act approved July 13, 1892		9,620.00
		9,634.13
June 30, 1893, amount expended during fiscal year		635.71
July 1, 1893, balance unexpended		8,998.42
July 1, 1893, outstanding liabilities	$706.59	
July 1, 1893, amount covered by uncompleted contracts	6,893.41	
		7,600.00
July 1, 1893, balance available		1,398.42
Amount that can be profitably expended in fiscal year ending June 30, 1895 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.		10,000.00

Abstract of bids for improving Mattawan Creek, N. J., by dredging, received and opened March 29, 1893, under advertisement dated February 18, 1893.

Name and address of bidder.	Rate per cubic yard.	Amount available for dredging.	Amount that can be removed with available funds.
	Cents.		*Cu. yards.*
R. G. Packard, New York, N. Y.	52	$7,600	14,615
P. Sanford Ross, Jersey City, N. J	56	7,600	13,571
Alonso E. Smith, Islip, N. Y.*	†25	7,600	30,400
	30		25,333

* Contract entered into May 3, 1893, for the removal of 25,000 cubic yards, more or less, of material.
† If material can be placed on bank without using scows.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Mattawan Creek, N. J., during the year ending December 31, 1892, were furnished by Mr. J. W. Maggs, of Mattawan, N. J.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Produce	80,000	$2,000,000	Steam	2	6½	228
Brick	150,000	550,000	Sail	20	6½	75
Fertilizers	80,000	350,000	Barges	100	6½	100
Lumber	10,000	10,000				
Coal and wood	5,000	7,000				
Miscellaneous	1,500	200,000				
Total	326,500	3,117,000		122		

The above table shows an increase of 126,650 tons over amount reported for calendar year 1891.

F 13.

IMPROVEMENT OF SHOAL HARBOR AND COMPTON CREEK, NEW JERSEY.

Shoal Harbor is situated on the south side of Sandy Hook Bay, 5 miles west of the entrance to Shrewsbury River, New Jersey. The harbor is formed by a slight indentation in the shore line where Compton Creek empties into the bay. The outer harbor is unprotected by projecting headlands or other natural topographical features. The creek is used principally as a harbor for small vessels engaged in the fish and oyster trade, and contains ample depth of water for this purpose, except at the entrance, which nearly runs dry at low water, thus preventing vessels from entering excepting at or near high water.

At a point about one-quarter of a mile above its mouth the creek is crossed by a fixed bridge without a draw, beyond which no vessels ever go. The village of Port Monmouth, located on the left shore of the harbor, is the principal shipping point for garden truck from the adjacent farming districts and for fish and oysters taken in the bay. These products are shipped directly to New York City markets, mostly by a steamboat drawing about 4 feet of water making daily trips between these points. The commerce at present amounts to about 62,000 tons per annum.

The plan of improvement adopted in 1884 had in view the connection of the 5-foot mean low-water curve of the creek on the inside with the 5-foot curve of the bay by means of a dredged channel 150 feet wide and the protection of this channel against shoaling by means of a timber dike placed on the west side of the harbor, at a total estimated cost of $64,130.

The first appropriation was made in the act of September 19, 1890, the wording being as follows: "Improving Shoal Harbor and Compton Creek, New Jersey, so as to give a channel 4 feet deep at mean low water, $5,000."

The total expenditure on this improvement to June 30, 1892, was $5,000, with which amount the channel was dredged to a mean low-water depth of 4½ feet for a distance of 1,200 feet, beginning near the bulkhead at the mouth of the creek, with a width of 100 feet for the first 800 feet and of 70 feet for the remainder.

An appropriation of $3,000 for continuing the improvement was made in the act of July 13, 1892, and a project for its expenditure in extending the dredged channel toward the deep water in Raritan Bay as far as the funds available will permit, maintaining the width of 75 feet and depth of 4 feet mean low water, was approved July 26, 1892.

Specifications were prepared and sealed proposals invited by advertisement dated February 18, 1893, for extending the channel from Compton Creek through Shoal Harbor toward Raritan Bay by dredging to a depth of 4 feet at mean low water and over a width of 70 feet, where the present depth is from 0 to 1 foot mean low water. No bids were received, however, at the date of opening, March 29, 1893, and it was subsequently recommended that the work be left in abeyance until such time as an advantageous offer might be obtained to do the work with hired plant.

A survey of this stream, beginning at the mouth of Compton Creek and extending through Shoal Harbor for a distance of about 4,000 feet toward the bay, was made during the month of October, 1892. This survey indicates a channel about 1,200 feet long, beginning at the bulk-

head at the mouth of the creek, with widths of from 60 to 80 feet and mean low-water depths of from 3.2 to 4.2 feet.

No active operations have been in progress during the fiscal year.

The expenditures during the fiscal year ending June 30, 1893, amount to $139.29 for survey and administration.

The sum of $8,000 can be profitably expended in further extending and deepening this channel to the 5 feet required by the project.

This work is in the collection district of Perth Amboy, which is the nearest port of entry; nearest light-house, Navesink Light, and nearest fort, fort at Sandy Hook, New Jersey.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
September 19, 1890	$5,000.00
July 13, 1892	3,000.00
Total	8,000.00
Amount expended	5,139.29

Money statement.

Amount appropriated by act approved July 13, 1892	$3,000.00
June 30, 1893, amount expended during fiscal year	139.29
July 1, 1893, balance unexpended	2,860.71
Amount (estimated) required for completion of existing project	56,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Shoal Harbor and Compton Creek, New Jersey, during the year ending December 31, 1892, were furnished by Capt. Benjamin Griggs, of Port Monmouth, N. J.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Farm produce	35,000	$135,000	Steam	1	4	496
Coal	3,000	10,000	Sail	150	2	20
Clams and fish	10,000	25,000				
Fertilizers	12,000	18,000				
Miscellaneous	2,000	30,000				
Total	62,000	218,000		151		

The above table shows an increase of 14,000 tons over calendar year 1891.

on the North Branch, 5 miles, and to Branchport, on the S
9 miles, at an estimated cost of $254,562.

The total amount expended on this improvement to June
$224,459.68, with which numerous dikes have been buil
tained and channels dredged and redredged in various p
branches of the river.

An appropriation of $10,000 was made in the river and
July 13, 1892. A project for the expenditure of a part of th
tion, viz, $4,000, in making necessary repairs to the dikes
by hired labor and purchase of materials in open market, w
July 20, 1892, and approved July 26, 1892, it being deem
to defer submitting a project for the expenditure of the
priation until a survey of the river could be made and the
priate localities for the expenditure of the funds thereby d

Under the above authority the dike at the mouth and
the right bank of the North Branch have been repaired a
at a cost of $2,338.11.

A survey of the river, beginning at the junction of the no
branches and extending up the north branch to the vicinit
was begun September 21, 1892, and completed October 7
survey indicated a good 6-foot channel about 100 feet wide
bar above Upper Rocky Point, and that the cross-over cha
in good condition, excepting in one place where it had sho
foot; also that no material change had taken place in the
ing to the south branch. These conditions may be seen o
panying map, made from the survey. During the past wi
(and even to some extent since navigation was resumed
months ago), the channels have undergone material chang
shifted by storms and tides. These changes were especially
below Oceanic, at the mouth of the south branch, and a
extremity of the cross-over channel, where the flood tide
vented from performing its full work, owing to the fact that
its way through the open gap between dikes C 2 and C 3,
the map. This gap is now filled with riprap and the div
current will probably prevent the formation of this shoal i

A project for the expenditure of the balance of the a
already alluded to, in dredging the channels of the nort

feet wide and 6 feet deep at mean low water, where existing mean low-water depths vary from 3 to 6 feet; also for the removal of shoals from the cross-over channel and at the entrance to the south branch, should the available funds permit. Bids were opened March 29, 1893, and the following were received: Elijah Brainard, 34⅛ cents per cubic yard; P. Sanford Ross, 36½ cents per cubic yard, and Edgar M. Payn, 37⅝ cents per cubic yard, measured in scows. The bid of Edgar M. Payn, although the highest, was recommended for acceptance by reason of its containing no provision against beginning work in accordance with the specifications, which was the case with the other two (abstract herewith). This recommendation was approved and a contract entered into April 13, 1893, for the removal of about 13,000 cubic yards of material.

The reports of the steamboat lines navigating the river as to the condition of the channels early in the spring were, for causes above explained, very unfavorable, and it soon became apparent that all available funds would have to be employed in pushing through channels for the steamers irrespective of any scheme of general improvement. The amount appropriated for this inland harbor being only about $5,000 per annum, it is evident that nothing can be done looking toward a permanent channel inclosed between low-water dikes (the only method by which a permanent way can be maintained), and that the money granted is only barely sufficient to keep the very variable and inconstant channels in repair. For this reason, when it was reported that a deep hole existed just above the Oceanic Bridge, far removed from the channel, and in quiet water, where the material dredged could be deposited without injuring any local interests, it was contemplated with great satisfaction. The contract with Edgar M. Payn, at 37⅝ cents, provided for putting the material ashore, but when the hole above mentioned was discovered, the contractor consented to do the dredging required at a much reduced price per yard (25 cents), and accordingly a supplementary contract, having this change in view, was entered into May 4 and approved by the Department May 15, 1893.

Work under the supplementary contract of May 4 was begun May 6 and was completed at the close of the fiscal year. This work consisted in the removal of various shoals from both branches of the river, as follows: In the north branch a channel 170 feet wide, 6 feet deep, mean low water, and 425 feet long, was dredged through a bar above Upper Rocky Point; a channel 100 feet wide, 6 feet deep, and 275 feet long, made through a bar in the cross-over channel, and a small shoal in the channel just below Dike C 2, removed. In the south branch the lower end of stone Dike C 4 was removed for a distance of 350 feet, and a channel 100 feet wide, 6 feet deep, and 450 feet long cut through from the channel of the main stem to a point in the channel of the south branch above the bars that obstruct its old outlet. The total amount of material removed under the contract was 18,565 cubic yards.

As above remarked, it was very fortunate that this method of disposal of dredged material was determined upon, for it enabled this office to do all necessary work demanded by the commercial interests of the river; this could not have been done at the original price per yard without trenching upon the fund reserved for dikes. As corresponding repairs of channels will be necessary next spring, it is now recommended that the unexpended balance of the fund reserved for dikes be diverted from the use intended originally, and that it be devoted to the improvements of navigation which will be asked for at that time.

The expenditures during the fiscal year amount to $3,186.87, as follows:

Dredging under contract	$1,167.53
Repairing dikes	1,011.71
Inspection	231.49
Survey	327.24
Drafting	75.00
Administration	373.90
Total	3,186.87

This work is in the collection district of Perth Amboy, which is the nearest port of entry; nearest light-house, Navesink Light; nearest fort, fort at Sandy Hook, N. J.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, is $22,680.83.

AMOUNTS APPROPRIATED.

Old project.

By act of Congress approved—	
August 30, 1852 (survey)	$1,500.00
March 3, 1871 (dredging)	14,000.00
March 3, 1873 (dredging)	5,000.00
Total	20,500.00

Existing project.

By act of Congress approved—	
June 18, 1878 (diking)	$18,000.00
March 3, 1879	10,000.00
June 14, 1880	30,000.00
March 3, 1881	86,000.00
August 2, 1882 (dredging)	30,000.00
August 5, 1886 (diking)	10,000.00
August 11, 1888	10,000.00
September 19, 1890	10,000.00
July 13, 1892	10,000.00
Total	214,000.00
Grand total	234,500.00
Amount expended	227,646.55

Money statement.

July 1, 1892, balance unexpended	$40.32
Amount appropriated by act approved July 13, 1892	10,000.00
	10,040.32
June 30, 1893, amount expended during fiscal year	3,186.87
July 1, 1893, balance unexpended	6,853.45
July 1, 1893, outstanding liabilities	5,173.01
July 1, 1893, balance available	1,680.44
Amount (estimated) required for completion of existing project	20,062.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	20,062.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of bids for improving Shrewsbury River, New Jersey, by dredging, received and opened March 29, 1893, under advertisement dated February 18, 1893.

Name and address of bidder.	Rate per cubic yard.	Amount available for dredging.	Amount that can be removed with available funds.
	Cents.		*Cubic yards.*
Elijah Brainard, New York, N. Y	34⅜	$5 000	14,389
E. M. Payn, Albany, N. Y*	37⅝	5,000	13,197
P. Sanford Ross, Jersey City, N. J	36⅛	5,000	13,700

* Contract entered into April 13, 1893, for the removal of 13,000 cubic yards, more or less, of material.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Shrewsbury River, New Jersey, during the year ending December 31, 1892, were furnished by Capt. James S. Throckmorton, of Red Bank, N. J.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Produce	220,000	$2,010,000	Steam	52	4½	350
Oysters and fish	8,000	800,000	Sail	88	3	25
Fertilizers	63,000	441,000	Barges	34	3	25
Coal	80,000	320,000	Rafts	32		
Lumber	1,000	20,000				
Miscellaneous	300,000	3,000,000				
Total	672,000	6,591,000		206		

The above table shows an increase of 49,000 tons over amount reported for year ending December 31, 1891.

F 15.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

In its original condition this stream had a depth of from 4 to 6 feet at mean low water for several miles above its mouth, and was obstructed at its outlet into the ocean by a sand spit, which had deflected the stream into a channel parallel with the beach, communicating with the ocean across shifting sand bars, on which the best depth did not exceed 1½ feet at mean low water; mean range of tide, 2.4 feet. In severe storms this channel was sometimes entirely closed by sand.

The project for its improvement was adopted in 1879, and contemplated dredging the lower river and obtaining by means of jetties a permanent outlet nearly at right angles to the beach, with a depth of 6 feet at mean low water, at an estimated cost of $52,120. This was increased to $72,000 in 1882, the increase being due to advanced prices and to a proprosed increase in the length of the jetties.

The amount expended under this project to June 30, 1887, was $39,000, with which two jetties had been constructed, but neither to its full length, appropriations having ceased in 1882. No permanent improvement had been effected.

A detailed account of this work was given in my report for 1891, p. 1010, *et seq.*

There were no expenditures on account of this work during the past fiscal year.

The work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. Nearest light-house, Great Beds Light, in Raritan Bay; nearest fort, fort at Sandy Hook, New Jersey.

Amount of revenue collected at the port of Perth Amboy during the fiscal year ending June 30, 1893, $22,680.83.

AMOUNTS APPROPRIATED.

By act of Congress approved—	
March 3, 1879	$12,000
June 14, 1880	20,000
August 2, 1882	7,000
September 19, 1890	2,000
Total	41,000
Amount expended	39,000

Money statement.

July 1, 1892, balance unexpended	$2,000.00
July 1, 1893, balance unexpended	2,000.00
Amount (estimated) required for completion of existing project	31,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

F 16.

PRELIMINARY EXAMINATION OF SEAFORD CREEK, LONG ISLAND, NEW YORK.

[Printed in House Ex. Doc. No. 38, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report dated September 22, 1892, by Capt. Thomas L. Casey, Corps of Engineers, of the results of a preliminary examination of Seaford Creek, Long Island, New York, made to comply with requirements of the river and harbor act approved July 13, 1892.

I concur in the opinion expressed by Capt. Casey, and by the division engineer that this creek is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF CAPT. THOMAS L. CASEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, September 22, 1892.

GENERAL: I have the honor to submit the following report upon a preliminary examination of Seaford Creek, Long Island, as ordered by the river and harbor act of July 13, 1892:

Seaford is a scattering village of a few hundred inhabitants, in the town of Hempstead, Long Island. It extends to the marsh back of

Hempstead Bay; and from the village a shoal and narrow creek winds through the marsh to the more open waters of the bay. The contour of this section of Long Island is such that it divides into many small watersheds, each draining down to the salt marsh on the shore in an independent creek, which then cuts a channel for itself through the marsh to the open bay. These creeks are all too crooked and shallow to have much commercial value, but with the rise of the tide enable small craft to reach the upland at certain points along the shore.

During recent years the water-supply department of Brooklyn has been extending its system through this section, drawing off the supply of fresh water from most of these creeks for miles. The result has been to raise the beds of the creeks and to diminish their usefulness. Seaford Creek has an advantage in location over most of them; it reaches the bay near the head of Great Island Channel, connecting with Jones Inlet after a course of about 6 miles, and with depths nowhere less than 5 feet mean low water, being thus readily navigable to vessels of about 150 tons. At the time of the examination a brick schooner of that capacity was lying at the head of the channel, lightering her cargo up the creek.

The creek proper is about three-fourths mile long, 30 feet to 50 feet wide, with a depth of less than 1 foot at mean low water; the mean rise and fall of the tide is about 3.5 feet. Between the mouth of the creek and the head of the channel, distant three-fourths mile, there are two reaches of bay water, 400 feet wide, a mud flat, barely covered at low water, through which winds a narrow drain from 1 to 2 feet deep.

At the head of the creek there are two coal yards and one lumber yard, dealing also in building material. A small amount of salt hay and manure is brought up the creek. One 10-ton sloop belongs in the creek and is apparently the largest boat that can reach the docks.

It is reported that 500 tons of coal, 100,000 brick, and 1,000,000 feet of lumber were handled at the docks last year, together with the catch of 20 oyster and clam boats having landings along the creek.

Large tracts in the village are being improved and divided up into building lots; at present its development is behind that of adjoining towns, where private parties have obtained possession of land along the creeks and improved them at their own expense.

* * * * * * *

It is not likely that the creek could be improved to such an extent as to draw off any considerable amount of freight from the railroads. The chief benefit would be as a convenience to small boating, adding to the oyster industry and drawing people to the town for the summer or for settlement. * * *

I have therefore to report that Seaford Creek is not worthy of improvement.

Respectfully submitted.

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, September 23, 1892.

Respectfully forwarded to the Chief of Engineers.

For the reasons stated by Capt. Casey, I consider that Seaford Creek, Long Island, is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer, Northeast Division.

F 17.

PRELIMINARY EXAMINATION OF CHANNEL CONNECTING FREEPORT WITH GREAT SOUTH BAY, NEW YORK.

[Printed in House Ex. Doc. No. 65, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit herewith a copy of report, dated September 23, 1892, by Capt. Thomas L. Casey, Corps of Engineers, of the results of preliminary examination of channel connecting Freeport with Great South Bay, New York, made to comply with provisions of the river and harbor act approved July 13, 1892.

Capt. Casey is of opinion that the channel is worthy of improvement by the General Government.

The division engineer, in transmitting the local officer's report, states that he does not regard Freeport Channel as worthy of improvement by the General Government.

I concur in the opinion of the division engineer.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brigadier-General, Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF CAPT. THOMAS L. CASEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, September 23, 1892.

GENERAL: I have the honor to submit the following report upon a preliminary examination for a channel connecting Freeport with Great South Bay, as called for in the river and harbor act of July 13, 1892:

Freeport is a village of 3,000 inhabitants situated on the south shore of Long Island, back of Hempstead Bay. From the upland a narrow creeks flows through the salt meadow to the bay. Hempstead Bay is merely a network of passageways separating into isolated patches the marsh land back of the ocean beach. The term "Great South Bay" is usually confined to the open water to the east; as used in the wording of the act authorizing this examination it is applied to the entire locality between the upland and the ocean beach. The desire of

the people of Freeport is such an improvement of the creek as will give them better facilities for reaching the navigable channels which extend to New Inlet, and thence to the open water of the ocean.

An examination of the creek and bay channels was made at low water and soundings taken for a distance of about 3 miles; information as to the condition of the lower bay channels was obtained from the native boatmen and from the latest U. S. Coast Survey charts.

Of the seven inlets along the beach from Rockaway to Fire Island, a distance of 30 miles, New Inlet is now in the best condition, maintaining a depth of from 6 feet to 8 feet at mean low water. Inside the inlet there is an almost direct channel to the mouth of Freeport Creek, a distance of 4½ miles. On the lower reaches the depth is nowhere less than 10 feet at mean low water, and a depth of about 4 feet at the same stage is carried to the mouth of the creek. The mean rise and fall of the tide is in the neighborhood of 4 feet. A bar obstructs the entrance into the creek, having a maximum depth of 2 feet at mean low tide. From the mouth of the creek to the head of navigation is about 1¼ miles.

For perhaps half a mile the creek runs along the upland in front of the village, giving an accessible water front. It is here essentially a canal, the fresh water from above having recently been impounded by the Brooklyn waterworks department, and is not more than 40 feet wide, running nearly bare at low water. After leaving the upland the creek increases in width and depth, the last reach being nearly 200 feet wide and from 4 feet to 5 feet deep at low tide.

Under the present conditions vessels drawing more than 4½ feet have to remain below and lighter up their cargo. The largest boats that enter the creek carry 40 tons. A list of vessels running to the creek has been prepared, giving name, tonnage, and draft. It includes 17 schooners with a tonnage varying from 20 to 150 tons, and draft from 3 to 11 feet; 21 sloops of 12 to 36 tons, draft 3 to 5 feet; 13 catboats of 5 to 8 tons, draft 2 feet; 2 steamers of 10 to 20 tons, 10 sloops and schooners, 20 yachts, 40 oyster boats, and 4 steamers are said to be owned in the creek, in addition to those mentioned above.

The chief business on the creek is the oyster industry, employing 100 men and bringing into the creek from 30,000 to 50,000 bushels per year. The general merchandise is estimated at 1,000 to 2,000 tons of coal, 500,000 to 1,000,000 brick, 250,000 to 500,000 feet of lumber, and 100 tons of fish.

There is no town or creek along the shore for a distance of 40 miles that is so favorably situated as Freeport for obtaining a practical connection with coastwise traffic. At East Rockaway Creek a longer distance must be improved before reaching the bay channels and the inlet is more obstructed. An unfavorable report upon a preliminary examination of East Rockaway Creek was made in 1888 by Capt. Derby. All the other creeks along this shore empty into a broad expanse of shoal water, requiring protection works in the exposed portions. At three such less favorable localities works of improvement have been undertaken by the Government. At others private parties have obtained possession of adjoining land and improved the creeks at their own expense, merely for the increased value given to real estate in the vicinity.

The improvement desired at Freeport Creek is a channel 40 feet wide and 4 feet deep at mean low water from the mouth of the creek to the head of navigation. * * * It is doubtful if such a dredged channel would be fully maintained by the creek, especially as the flow of fresh

water has been recently cut off; in fact, a deposit of mud several inches deep has already formed since the closing of the dam nearly one year ago. Still some permanent improvement could be reasonably expected. A survey would cost $500.

Having in view all of the conditions above given, and especially the natural advantages and apparently flourishing state of the community to be benefited, I am of the opinion that Freeport Channel is worthy of improvement by the Government.

Respectfully submitted.

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, September 26, 1892.

Respectfully forwarded to the Chief of Engineers.

Inasmuch as a deposit of mud several inches deep has formed since the closing of the dam about a year ago, this channel appears to be undergoing natural deterioration, and hence, in all probability, to maintain the desired increased depth will call for dredging frequently repeated. This will involve an outlay, in my judgment, not justified by the commercial importance of the place.

I do not, therefore, regard the Freeport Channel as worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer, Northeast Division.

F 18.

PRELIMINARY EXAMINATION OF WHALE CREEK, NEW JERSEY.

[Printed in House Ex. Doc. No. 89, Fifty-second Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 5, 1892.

SIR: I have the honor to submit the accompanying copy of report dated October 4, 1892, from Capt. Thomas L. Casey, Corps of Engineers, of the results of a preliminary examination of Whale Creek, New Jersey, made to comply with provisions of the river and harbor act approved July 13, 1892.

It is the opinion of Capt. Casey, concurred in by the division engineer and by this office, that the creek is not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. S. B. ELKINS,
Secretary of War.

REPORT OF CAPT. THOMAS L. CASEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, October 4, 1892.

GENERAL: I have the honor to report as follows upon a preliminary examination of Whale Creek, New Jersey, as called for by the river and harbor act of July 13, 1892:

Whale Creek is in the town of Mattawan, Monmouth County, situated between Cheesequakes and Mattawan creeks, and draining about 1½ square miles. It is a tidal creek, typical of the New Jersey marsh land, narrow and winding, and would be insignificant but for the deposits of clay on the upland near its banks. The creek empties into Raritan Bay on the south shore, 1½ miles west of Keyport Harbor. It is 50 feet wide at its mouth, narrowing to 20 feet at the fixed highway bridge three-fourths of a mile above.

One-half mile above the mouth there are two brickyards, having a capacity of from 10,000,000 to 15,000,000 brick per annum, all shipped by way of this creek. It is here 30 feet wide and from 3 to 4 feet deep at mean low water. Throughout the lower 500 feet of the creek the width increases to 40 and 50 feet, while the depth decreases to a few inches. At the outlet in the bay it becomes bare at low water. Here there is a larger brickyard, having a capacity equal to that of the two others combined. The traffic is now confined to small schooners, sloops, and canal boats; 100 tons is the maximum cargo, and 3½ to 4 feet the extreme draft that can be carried out of the creek. The passage in and out of the mouth is dangerous, and is limited to the period of high water and to the extent of tidal flow, which averages 4.5 feet.

Aside from the brick shipped from the three yards mentioned, there is but little traffic on the creek. The surrounding region is devoted to garden-truck farming, for which some fertilizer is brought in by vessel, and a small amount of coal enters the creek for the brickyards and neighboring farmers. The nearest villages, Keyport and Mattawan, have waterways of their own. Any possible improvement of the creek would therefore increase the general freighting but little, since Keyport and Mattawan are distant but 1 and 2 miles, respectively, with better facilities for shipment than Whale Creek can ever possess.

If the mouth of the creek were opened and regulated it would be a convenience to the present brick and clay interests, would result in some reduction in freights, and no doubt stimulate business on the creek. There are two other brickyards less than a mile from the creek now shipping entirely by rail, which, with better facilities for navigating the creek, would probably make use of this method of shipment. Any large growth, however, could not be expected because of the competition from the brick and clay interests of Mattawan Creek, Keyport Harbor, and Cheesequakes Creek. Still the amount of brick now shipped is large for so small a waterway, and constitutes a considerable industry. Some statistics bearing on this have been collected by Mr. William E. Kinkle, owning one of the yards on the creek, which I believe to be a fair statement, as follows:

	July 1, 1890, to July 1, 1891.	July 1, 1891, to July 1, 1892.
Brick shipped	29,000,000	19,000,000
Tonnage	145,000	95,000
Freight, at $1.25 per 1,000	$36,000	$23,500
Value	$142,000	$96,000
Manure, lumber, etc. (tonnage)	500 to 900	400 to 800
Entered the creek (value)	$3,900 to $6,500	$2,500 to $5,000

The people request a channel 4 feet deep at mean low water, connecting the creek with the corresponding depth in the bay. The examination showed that the tidal currents maintain that depth only where the width is 30 feet or less. The 4-foot curve in the bay is about 1,000 feet from the shore. The dredged channels into the bay, exposed to northeast storms, direct from the Atlantic and also from the northwest to some extent, have proved, when tried, as at Cheesequakes and Port Monmouth, to be failures. Extensive protecting works would be required to insure permanence. The condition of the creek seems to indicate that dikes could hardly be located in such a manner as to give the required scouring velocity without interfering with the free entrance to the tidal wave. At Cheesequakes the opening between dikes is 200 feet and the currents have failed to keep open the dredged channel, while beyond the dikes it has entirely disappeared.

An opening of possibly 40 feet between dikes is as much as would maintain the required depth in this creek. By building flaring wings at the outer end to make the entrance easier and less dangerous this width would be passable. The dikes could be built cheaply, except at the outer end, where some stone-filled crib or timber work would be required. * * *

Such an improvement should reduce the freight on brick by 20 cents per 1,000, resulting in an annual saving of over $5,000. * * *

The deepening of this creek being a matter for the benefit of very few interested parties, I am of the opinion that it is not worthy of improvement by the Government.

Respectfully submitted.

THOS. L. CASEY,
Captain, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, October 8, 1892.

Respectfully forwarded to the Chief of Engineers, U. S. Army. For the reasons within stated I consider that Whale Creek, New Jersey, is not worthy of improvement by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Engineer, Northeast Division.

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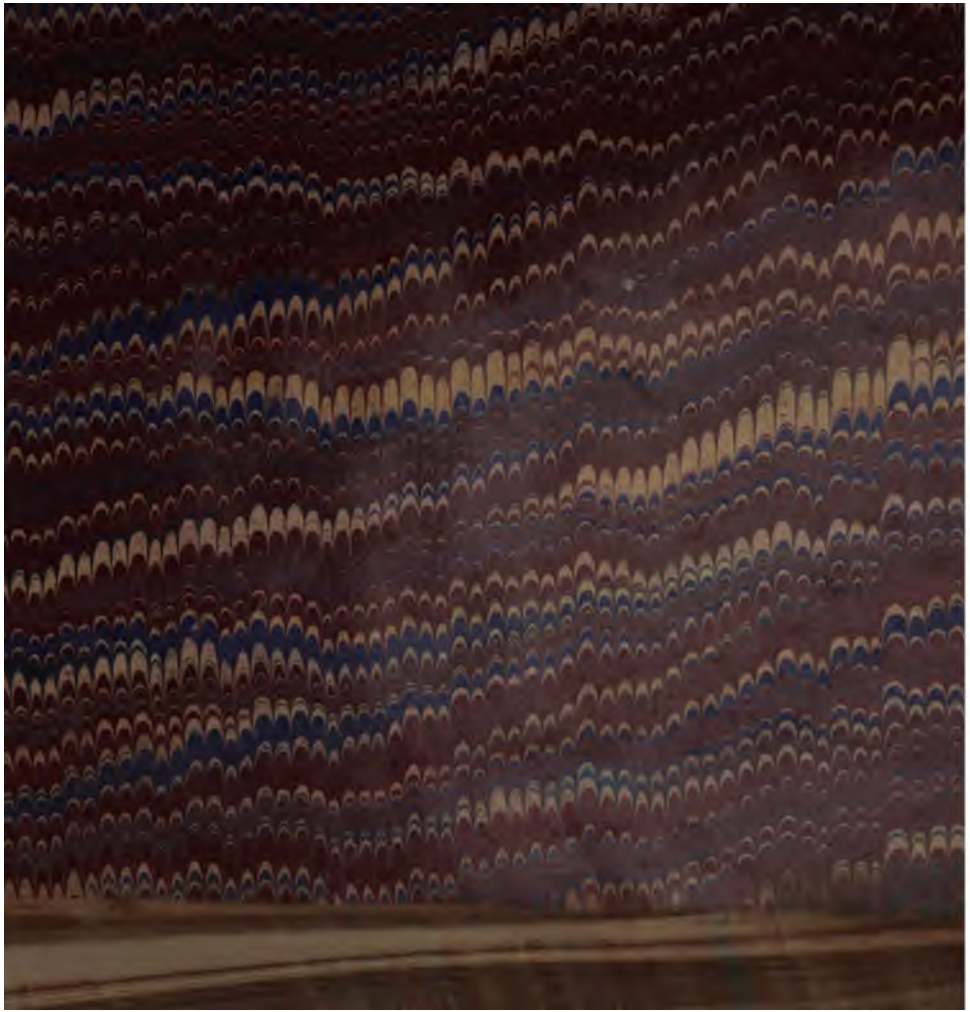
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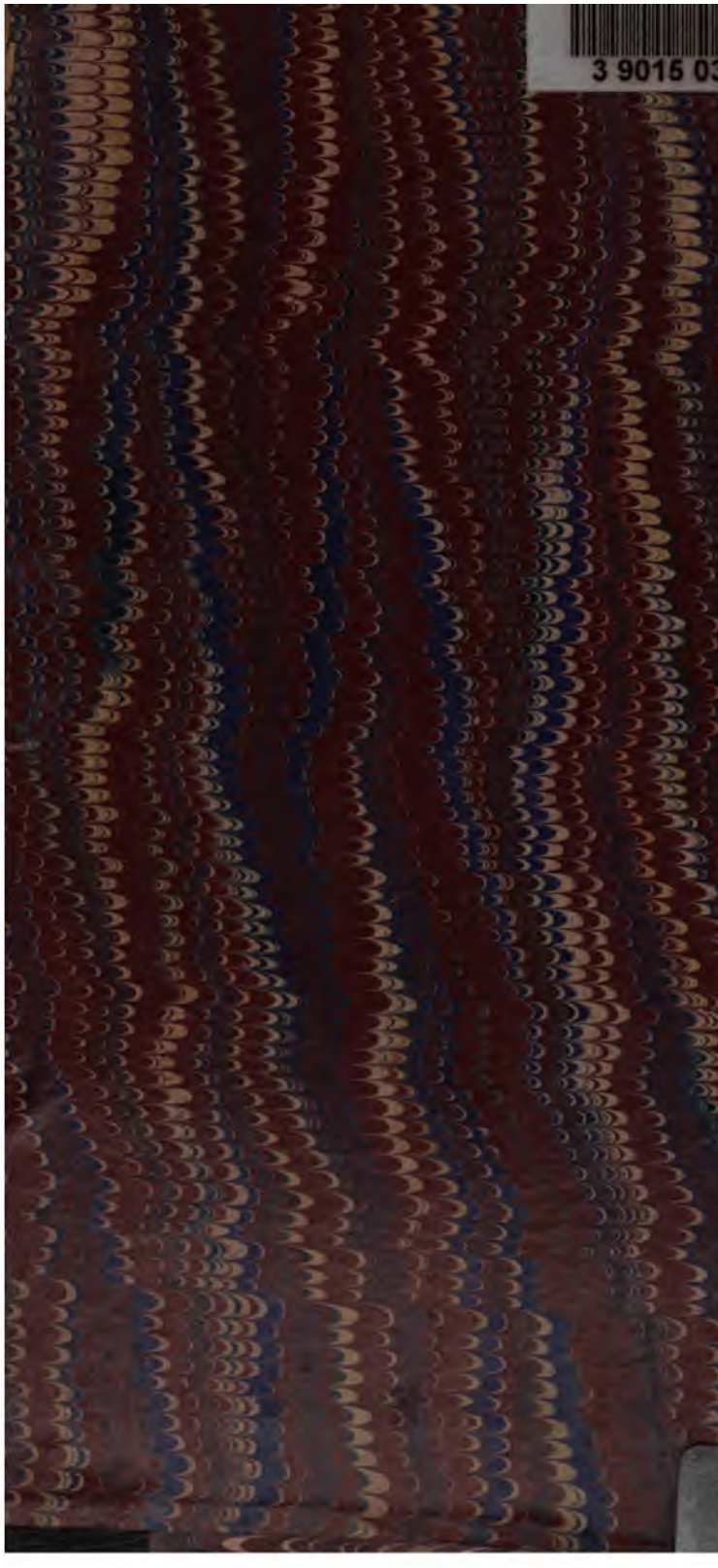
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